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PARACHUTE RIGGER

VOL. 2

Prepared by

U.S. BUREAU OF NAVAL PERSONNEL

NAVY TRAINING COURSES

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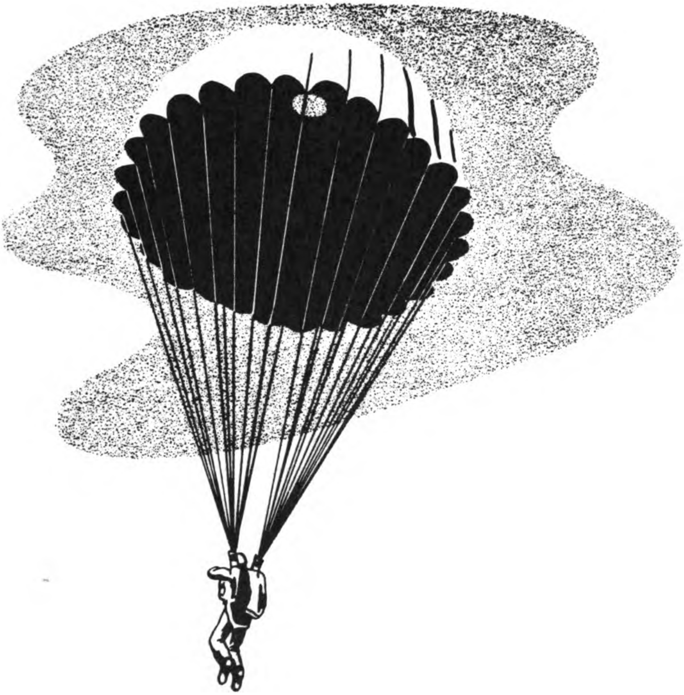


CHAPTER 1

FASTENERS

In parachutes, a type of fastener that will firmly hold, is an absolute necessity. Such implements, many of them truly ingenious units, will be considered in the following pages.

SLIDE FASTENERS

A ZIPPER or slide fastener is comparatively simple in construction, but often proves quite troublesome. Figures 1 and 2 are presented to familiarize you with the names of the various parts of slide fasteners so that he will experience no difficulty in following directions concerning their operation and installation.

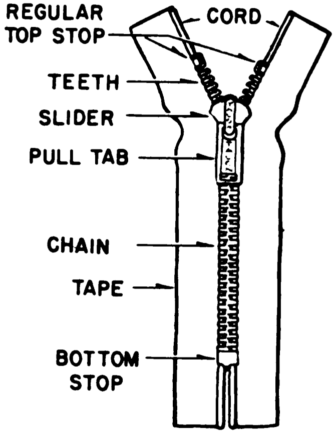


Figure 1.— Regular type slide fastener.

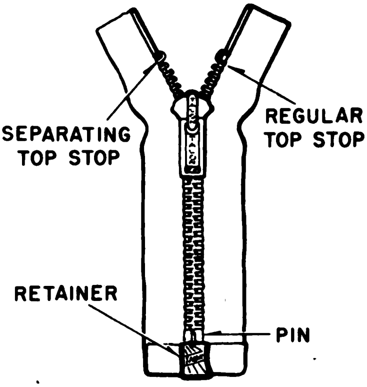


Figure 2.— Separating type slide fastener.

Close inspection of the slide fastener will disclose two rows of teeth (hollow cones or scoops) facing each other. When brought together at the proper angle, each tooth is designed to fit within the tooth opposite.

Once closed, slide fastener teeth cannot be parted except through use of the SLIDER which provides the proper angle for teeth meshing and unmeshing.

The small clips at the top and bottom of slide fasteners are designed to keep the slider from running off the track. Certain types of fasteners are equipped with a small RETAINER and PIN arrangement on the bottom to permit the fastener to separate.

PRECAUTIONS

NAVY SPECIFICATIONS REQUIRE THAT A SLIDE FASTENER BE OPERATED BACK AND FORTH 10,000 TIMES WITHOUT FAILURE OR UNDUE SIGNS OF WEAR. Operated twice a day, a slide fastener at this rate should last at least 14 years without difficulty.

Ordinary zippers are designed for flat, smooth operation, and both hands are required for proper functioning. The chain should be stretched taut with one hand and the slider worked (*without force*) with the other.

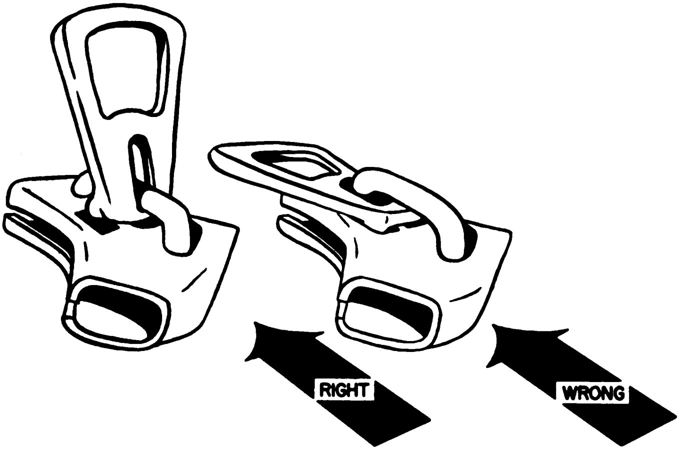


Figure 3. — Locking sliders.

If a garment is composed of soft, nappy material or lined with wool or fur, the slide fastener should be operated with great care to prevent the slider from being jammed, the cord from being cut, or the teeth from loosening.

Grease or oil often lodge between the tiny hollow parts of the teeth, thus causing stiff operation of the slider.

A casual inspection will determine whether a slider is of the locking type. Always be certain that the PULL TAB is lifted at right angles to the slider before attempting to move the latter. Figure 3 shows the relative positions of the pull tab.

TROUBLE SHOOTING

A torn or ripped cord cannot be patched, but should be replaced with a complete new zipper. If the cord is damaged very near the top or bottom of the fastener, and the injured ends can be cut off to shorten the zipper without hampering the usefulness of the garment, an effective repair can be made.

Loose or missing teeth and stops will cause trouble sooner or later. If teeth or stops are not tightened, they will eventually be lost and tear the cord. In repair of such damage, see that the loose stop nearly touches the teeth, then squeeze tightly with pliers. Set the loose teeth parallel with those adjacent, and apply pressure with pliers. If a stop is missing, it may be replaced or, in an emergency, soft wire or heavy thread may be substituted.

A missing tooth can be replaced by carefully removing two opposite teeth from the bottom or top of the chain. This will keep both sides of the chain the same length.

Difficulty in moving the slider may be caused by the jaws of the slider being too tight. Insert a screwdriver between the jaws and very gently pry them apart until free operation is effected. If teeth are gummed with oil or grease, wipe or scrub the chain with a piece of rough material, an old toothbrush, or even a pipe-cleaner saturated with carbon tetrachloride. To lubricate the chain, apply ONE DROP of oil between thumb and forefinger and run the chain up and down between the fingers.

Should the slider become jammed with fur, wool, or other material, carefully remove such matter with a pin or needle while gently pulling the slider until it is released. If it is so badly jammed that it resists all efforts, remove the slider by carefully bending the jaws apart and returning the jaws to their original position; then replace the slider on the chain.

The majority of pull tabs have two small projections fitting into slots on each side of the slider. To remove the pull tab, use two pairs of pliers, one on each side, and twist in opposite directions. In replacing pull tabs, this procedure is reversed.

A smashed slider may be removed by inserting two small screwdrivers to force the jaws apart.

MAJOR REPAIRS

Most zipper trouble may be traced to a bent slider in which the jaws are either spread too far apart or too close together, instead of being parallel. The following is an explanation of the proper removal of a slider from the chain and its replacement following repair. Since the REGULAR TYPE and SEPARATING TYPE zippers are considerably different, they will be treated separately.

TO REMOVE THE SLIDER FROM A REGULAR-TYPE ZIPPER, carefully rip the stitches from the bottom of the zipper to expose the ends of the tape. Then remove the bottom stop and slip the slider off the bottom of the chain and entirely off the cords and tape. Repair the zipper as demonstrated in figures 5, 6, and 7. If repair is impossible, discard the zipper in favor of a new unit.

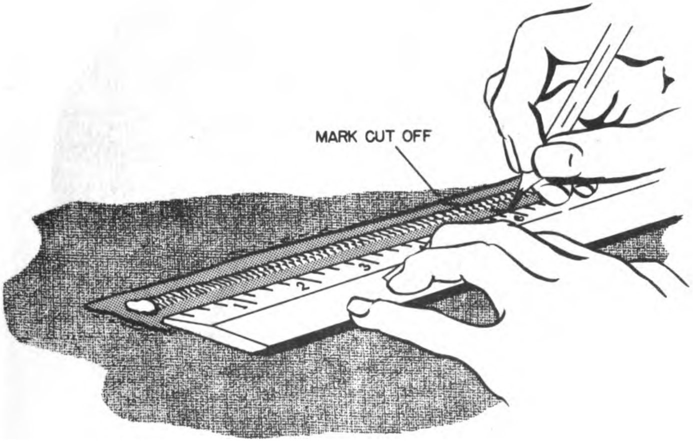


Figure 4. — Mark from bottom stop upward.

TO REPLACE THE SLIDER ON A REGULAR-TYPE ZIPPER, thread the two bottom cords into the wide end of the slider. Hold the tape so that the bottom teeth are correctly matched, then draw the slider upward until the teeth mesh for several inches. Without allowing the teeth to separate, clamp the bottom stop close to the teeth and over both cords. Replace taped ends and ripped stitches by hand or machine.

TO REMOVE THE SLIDER ON A SEPARATE-TYPE ZIPPER, carefully rip the stitches at the TOP of the zipper, on the RETAINER

SIDE only, thus exposing the end of the tape. Remove the top stop, slip the slider off the top of the chain, and completely remove it from the cord and tape. Repair or replace the slider.

To REPLACE THE SLIDER ON A SEPARATE-TYPE ZIPPER, thread the RETAINER SIDE cord into the narrow end of the slider and allow the slider to slip down the chain. Replace the taped end and ripped stitches by hand or machine.

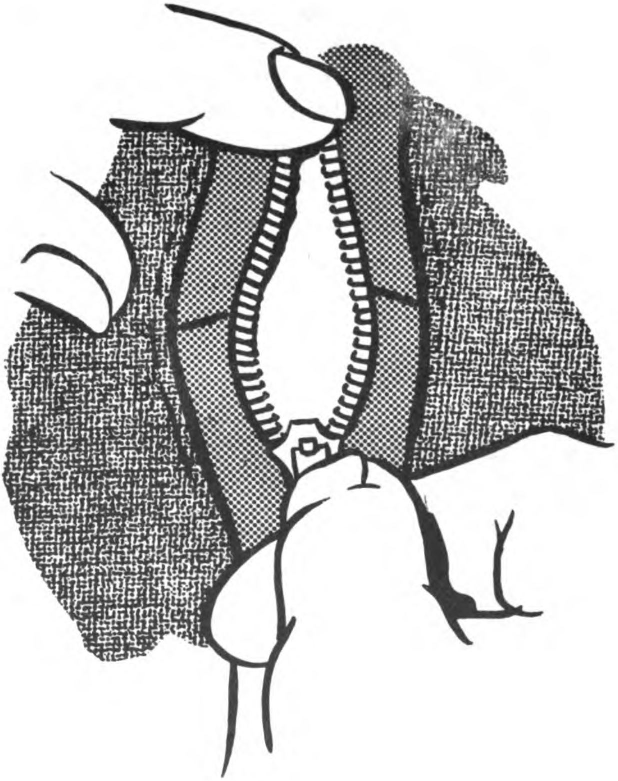


Figure 5. — Open chain below pencil mark.

SHORTENING A ZIPPER

To shorten a zipper, first determine the length required. The chain should be about one-half inch shorter than the opening in the material or garment. Mark the desired length, measuring from the bottom stop upward as shown in figure 4.

Open the chain to any point BELOW this pencil-mark, as shown in figure 5.

Cut directly across the tape about one or one and one-half inches below the mark, as figure 5 indicates. Then cut off the TEETH from the mark to the end of the tape. Cut an equal number of teeth from each side of the chain. Figure 6 illustrates this step.

When the two stops are attached, the zipper is completely shortened.

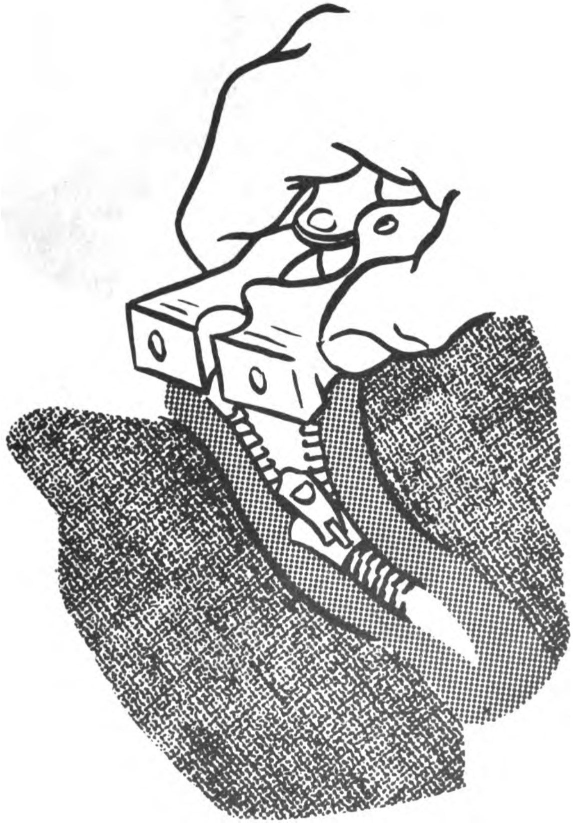
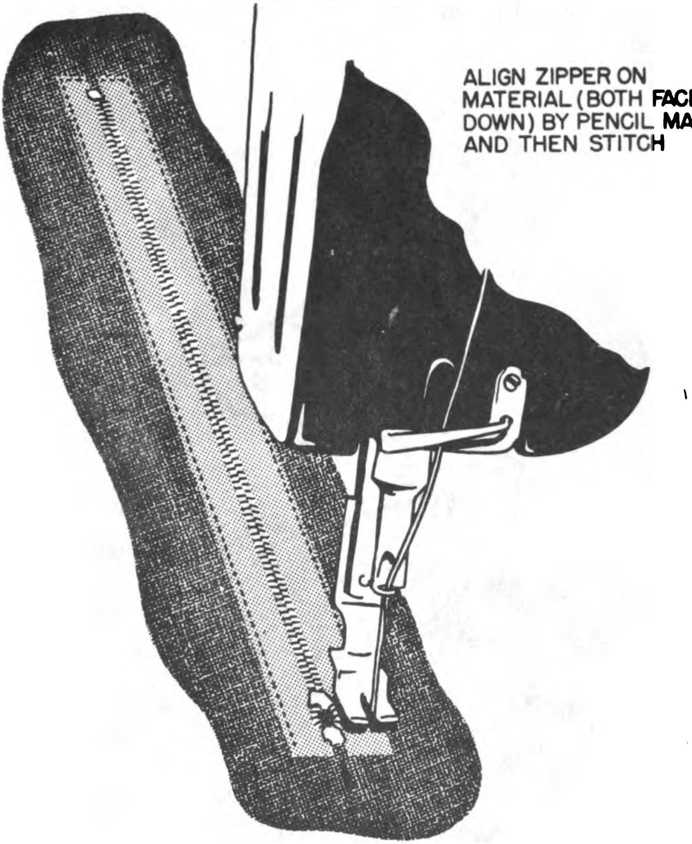


Figure 6. — Cut close to the cord.

SEWING

If the sewing machine manfuacturer cannot supply you with a REGULAR ZIPPER PRESSER FOOT, right or left, for your machine, one can be readily made. File or grind the left side of an old presser foot to permit sewing to within 1/8-inch of the chain.



ALIGN ZIPPER ON MATERIAL (BOTH FACE DOWN) BY PENCIL MARKS AND THEN STITCH

Figure 7.— Installation ot a zipper. Step 1.

The zipper presser foot will serve not only as a guide for a neat row of stitches, but will also prevent the foot from "riding up" on the chain. A foot of this type will prove a handy accessory in the performance of a great amount of zipper work.

When sewing, always stretch the zipper and not the material. This makes for a flat, neat job.

A simple method of installing a zipper when making a bag, or cover with two closed ends, is described as follows: Lay the piece of material to contain the zipper right side down, and place the zipper right side down on top and in the center of the material, as shown in figure 7. Run a row of stitches completely around the outer edges of the tape. Turn the material over, and by feeling with scissors-points, cut directly down the center of the chain and snip a "V" at each end, as shown in figure 8.

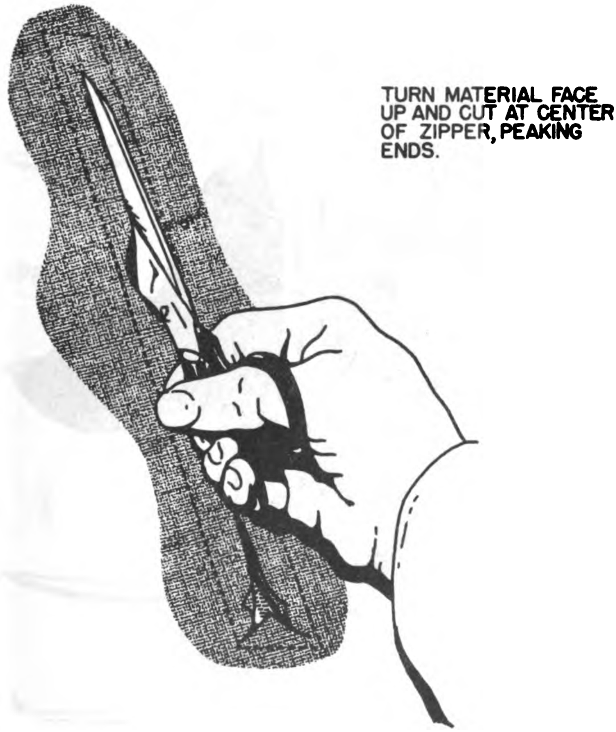

TURN MATERIAL FACE UP AND CUT AT CENTER OF ZIPPER, PEAKING ENDS.

Figure 8. — Installation of a zipper. Step 2.

Turn the edges of the material under, thus exposing the chain. Allow sufficient space so that the slider will not rub the edge of the hems. The "V" at each end will permit the sewing of neat, square corners (see figure 9).

ZIPPER KIT

In addition to common tools such as screwdrivers, pliers, awls, knives, scissors, and needles, a well-equipped zipper kit should also be included in the loft.

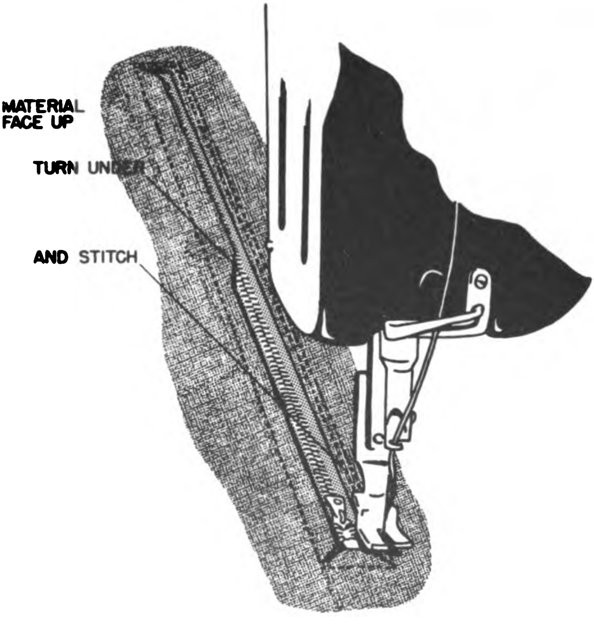


Figure 9. — Installation of a zipper. Step 3.

Four indispensable tools are illustrated in figure 10 — pull-up pliers, nippers, stop-closing pliers, and a bent-tip awl.

End cutters or nippers are used for removing or cutting off stops and teeth. Stop-closing pliers are designed to span over the slider and clamp the stops in position. An awl with a bent tip is a handy implement for closing the teeth by hand.

In the preceding pages, instructions for removing and replacing a slider from the TOP of a regular-type zipper were purposely omitted because this operation requires the use of a special tool. As a zipper-repairman, you will need a set of PULL-UP PLIERS for your kit, one for each side of a zipper.

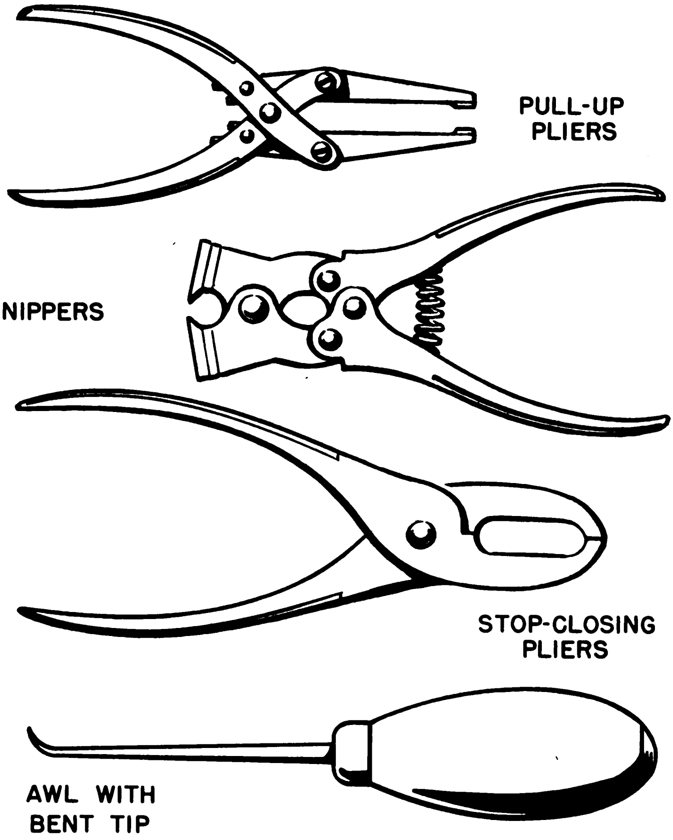


Figure 10. — Four indispensable zipper-kit tools.

To replace the slider on the top of a regular-type zipper with the aid of pull-up pliers, slip the tool over the bottom stop, clamp together, and pull upward exactly like a slider as shown in figure 11. Close the entire chain in this manner. Thread the two top cords into the narrow end of the slider, holding the teeth meshed until they enter the slider. Replace the top stops, taped ends, and ripped stitches by hand or machine.

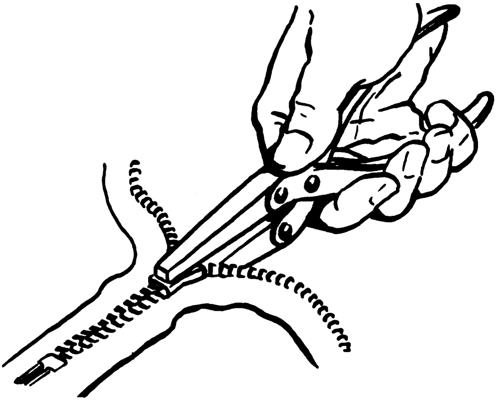


Figure 11. — Closing zipper with pull-up pliers.

Study figure 12 carefully. This illustration is a reproduction of AN Standard Drawing number 229 for Fastener-Interlocking Slide.

DOT FASTENERS

Dot-type fasteners are designed for innumerable purposes for use on items ranging from parachutes to wrist-watch bands. Their grip is tenacious, although they readily and easily respond to pulling. For the purpose of our discussion, dot-type fasteners are used on parachutes, flight gear, electrically-heated flying suits, life rafts, mooring kits, emergency rescue equipment, engine covers, sleeping bags, and other related accessories.

LIFT-THE-DOT

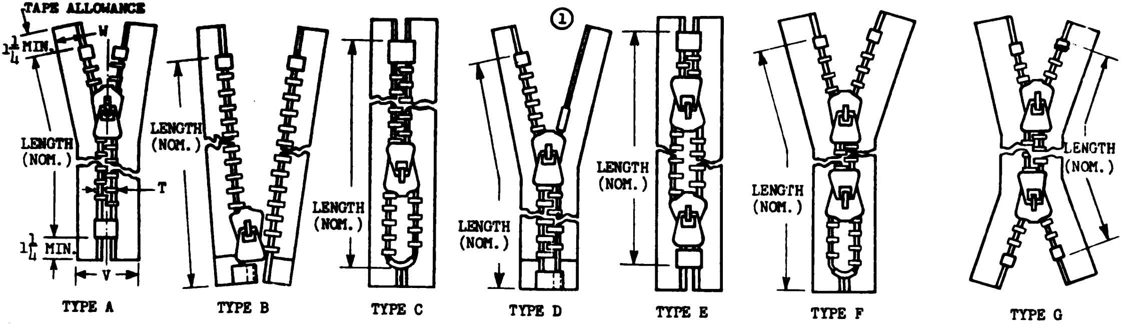
"Lift-the-dot" fasteners are used mainly on cockpit and engine covers. This type of fastener will not open unless the "dot" is lifted.

The dot is located at one end of the socket, and it may readily be seen why these units cannot be successfully used on parachute lift web keepers on SS back pads, since they respond to one

ARMY-NAVY AERONAUTICAL STANDARD

FASTENER - INTERLOCKING SLIDE

AN229



SIZE	TYPE	STYLE	T	V ±5/32	W
00	A OR C	S OR L	5/32	29/32	7/16
0			5/32	29/32	7/16
1	A TO G (INCL.)		1/4	1-1/4	9/16
2			1/4	1-1/2	3/4
3			3/8	2-1/4	1
4			1/2	2-3/8	1

DIMENSIONS IN INCHES. TOLERANCES: FRACTIONS ±1/32, UNLESS OTHERWISE SPECIFIED.

RIGHT SIDE SLIDE ASSEMBLY IS STANDARD FOR TYPES B AND D SEPARATING FASTENERS; SPECIFY LEFT SIDE SLIDE ASSEMBLY WHEN REQUIRED. SEE PROCUREMENT SPEC. FOR DATA ON PULL SLOTS FOR THONGS. THONGS NOT RECOMMENDED FOR USE WITH MANUALLY LOCKING OR SEMI-AUTOMATIC LOCKING FASTENERS.

THIS DRAWING AND THE SPECIFICATION COMPLEMENT ONE ANOTHER, AND, TOGETHER COMPLETELY DEFINE THIS PRODUCT.

CODE

SIZE 00 = EXTRA LIGHT SERVICE.
SIZE 0 = LIGHT SERVICE.
SIZE 1 = MEDIUM SERVICE.
SIZE 2 = HEAVY SERVICE.
SIZE 3 AND 4 = EXTRA HEAVY SERVICE.

TYPE A = NON-SEPARATING, SINGLE ACTION.
TYPE B = SEPARATING, SINGLE ACTION.
TYPE C = NON-SEPARATING, SINGLE ACTION WITH BRIDGE STOP.
TYPE D = SEPARATING, SINGLE ACTION, QUICK DETACHING.
TYPE E = NON-SEPARATING, DOUBLE ACTION, CENTER OPENING.
TYPE F = NON-SEPARATING, DOUBLE ACTION WITH BRIDGE STOP.
TYPE G = SEPARATING, DOUBLE ACTION, END OPENING.

STYLE S = STANDARD NON-LOCKING.
STYLE L = LOCKING.

GRADE I = BRASS.
GRADE II = OTHER METALS OR ALLOYS.

1ST DASH NO. SHALL INCLUDE SIZE, TYPE, STYLE, AND LENGTH (EXPRESSED IN 1/4 INCH INCREMENTS). 2ND DASH NO. SHALL INDICATE GRADE.

EXAMPLES OF PART NO.: AN229-2AL25-I = HEAVY SERVICE, NON-SEPARATING, SINGLE ACTION, LOCKING, 6-1/4 (25/4) LONG, GRADE I
AN229-1BS35-II = MEDIUM SERVICE, SEPARATING, SINGLE ACTION NON-LOCKING, 8-3/4 (35/4) LONG, GRADE II.

APPROVED 13 Sep 43 REVISED ① 23 Dec 43

Figure 12. — Fastener-interlocking slide.

direction of pull only. These units are used, however, on certain back-pad keepers which hold the cross shoulder straps and back strap.

Lift-the-dot fasteners come in two sizes, both REGULAR and MINIATURE, and may be set by hand or with PRESS AND DIES.

SETTING LIFT-THE-DOT FASTENERS

Figure 13 illustrates the setting tools necessary for setting lift-the-dot fasteners either by hand or press.

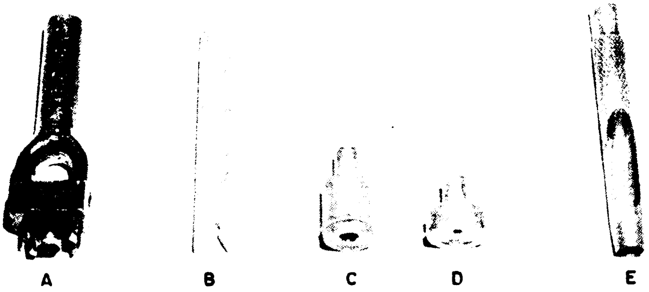


Figure 13. — "Lift-the-dot" setting tools.

Mark out the setting positions along the hem with a colored pencil. Use tool (A) for the regular-size lift-the-dot, and with a rawhide mallet pound out the holes and cuts for the SOCKET

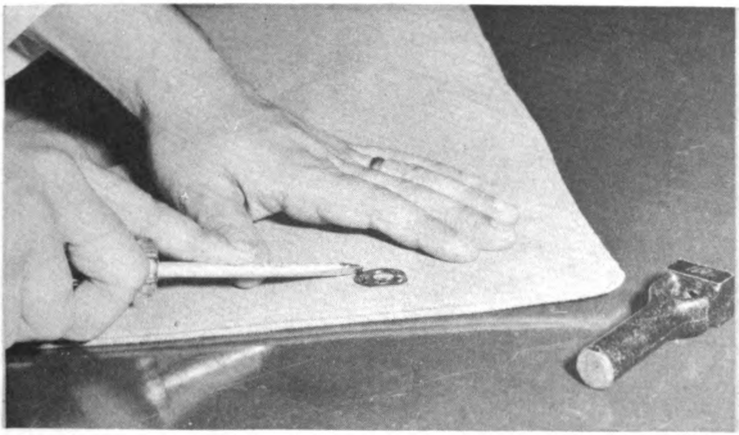


Figure 14. — Setting socket and clinch plate.

AND CLINCH PLATE. Socket prongs are passed through the material and through the holes in the clinch plate, and firmly bent over, as shown in figure 14.

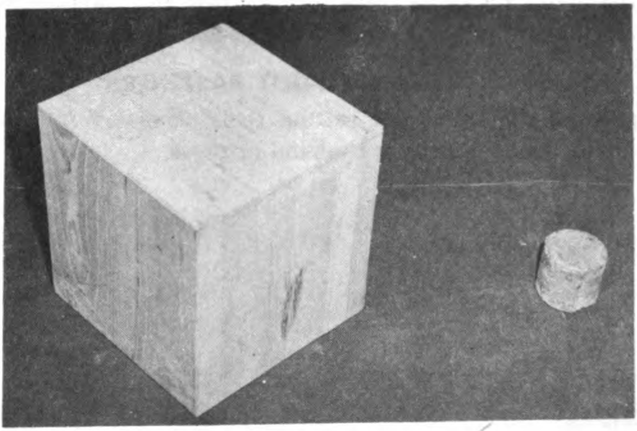


Figure 15. — Cutting blocks

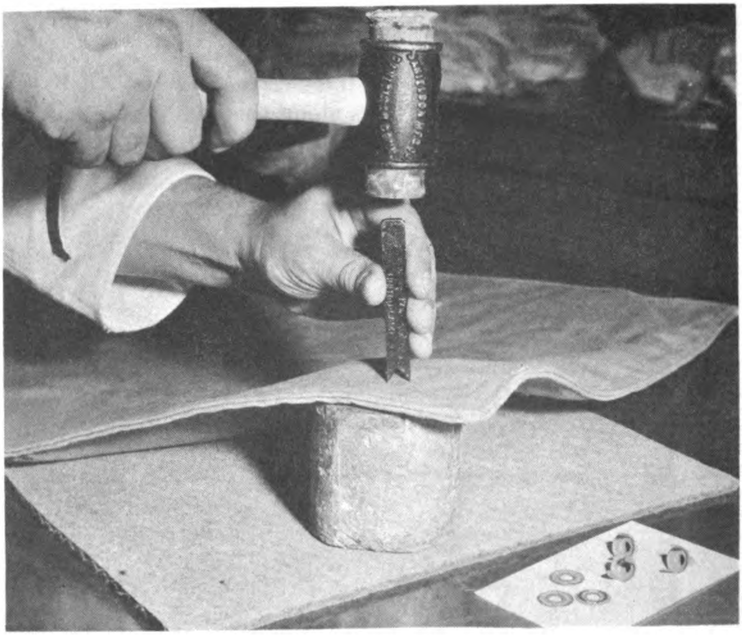


Figure 16. — Setting the clinch-type stud.

A wooden or lead CUTTING BLOCK offers excellent cutting and cushioning effects. Units of this type are illustrated in figure 15.

With tool (B), figure 13, and a rawhide mallet, cut the two slits necessary for setting this type of stud and washer. This step is shown in figure 16.

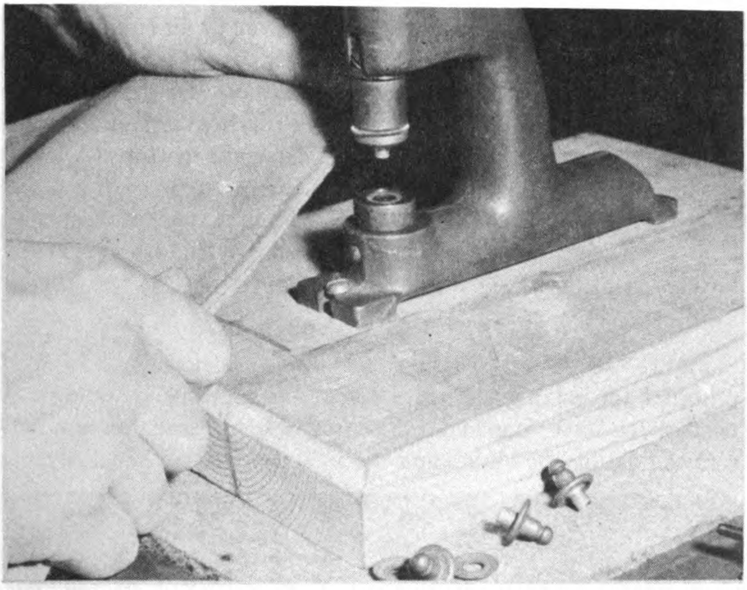


Figure 17. — Setting tubular stud.

If the tubular rivet-type stud is used, a grommet punch of the proper diameter is necessary for cutting a hole through which the stud must pass. Two setting dies (chuck and die), (C) and (D) figure 13, are placed in a hand press, and the tubular stud pressed over the washer as shown in figure 17. This completes the setting. Engage the stud in the socket and check its action.

DURABLE DOT FASTENERS

The DURA-DOT fastener is the most popular in the parachute field. This unit is more compact than the lift-the-dot type. It lies flatter, and will open when pulled in any direction. When properly set, its grip is strong, and it can be depended upon to hold securely.

Dura-dot fasteners are used on all back pad keepers, certain chafing bags, and on flight clothing of every description.

The BUTTON and SOCKET of the dura-dot are generally set together as a pair, as also are the STUD and EYELET. The button-socket comprises the female section of the fastener, while the stud and eyelet make up the male section. The same holds true with ANZO DOTS, DOT SNAPPERS, and SEGMA DOTS.

Before setting the fastener in fabric, see that the area is properly reinforced with a hem or patch. Do not attempt setting the regular dura-dot, which is the heaviest of its type, in two or three thicknesses of light-weight cotton (A or B cloth). Instead, use a smaller fastener, such as the BABY DURA-DOT or the SEGMA DOT. There will naturally be exceptions to this rule, but common sense will prohibit the use of a heavy button on flimsy, light material.

SETTING THE DURABLE DOT

Figure 18 illustrates the setting tools and hand press required for setting the dura-dot. The screwdriver shown is needed for loosening and tightening the top and bottom set-screws holding the chuck and die in the press. When inserting

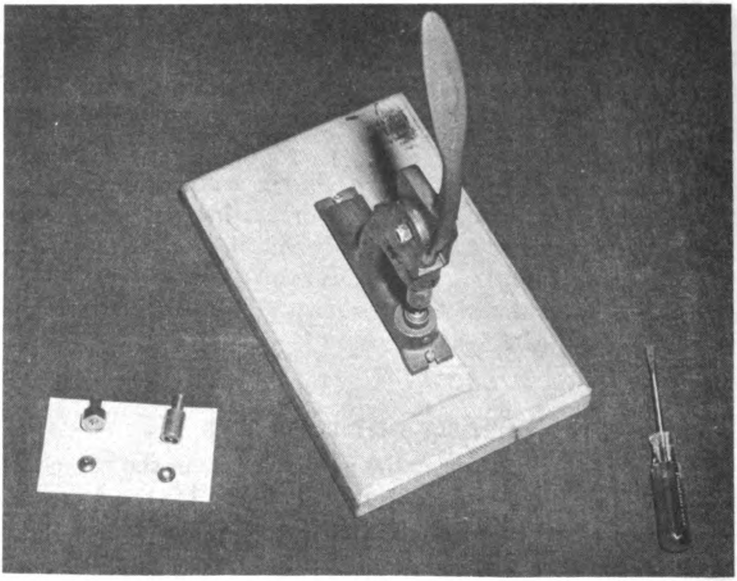


Figure 18. — Dura-dot setting tools and hand press.

the chuck and die, make certain that the small, flat surface on the shank is in line with the set-screw holes in the press. This prevents scarring the shank, which will eventually hamper removal of setting tools from the press.

Use a grommet punch of the proper diameter to punch the holes for receiving button and eyelet. Set up the hand press with chuck and die used for setting the button and socket. Insert the button through the cloth and place it in the die of the press, position the socket, and squeeze together by applying pressure to the press lever. Figure 19 illustrates this step.

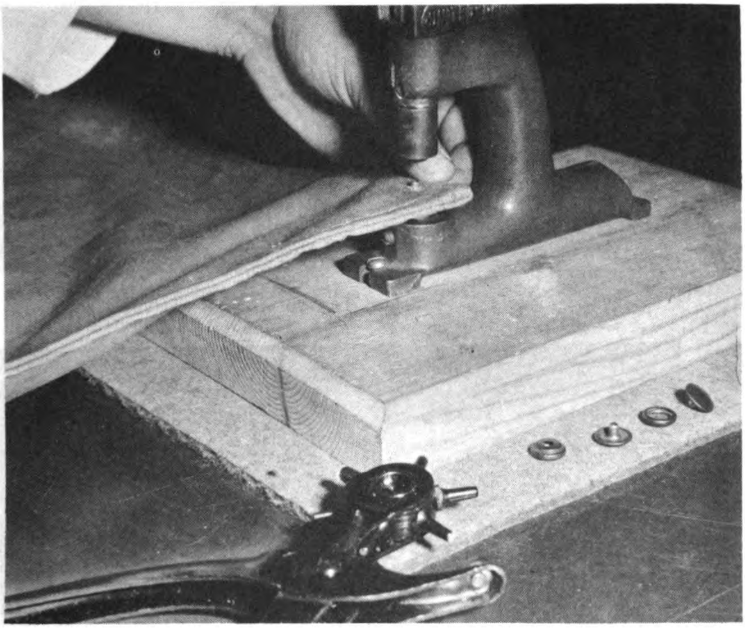


Figure 19. — Setting dura-dot button and socket.

Complete the setting of the female portions of the fasteners (when several settings are to be made) before the chuck and die are changed for setting of the male sections.

To set the stud and eyelet, remove old setting tools and insert the proper chuck and die. This operation, described in figure 20, is the same as for setting the button and socket. The eyelet sets on the bottom die and the stud is pressed by the top chuck.

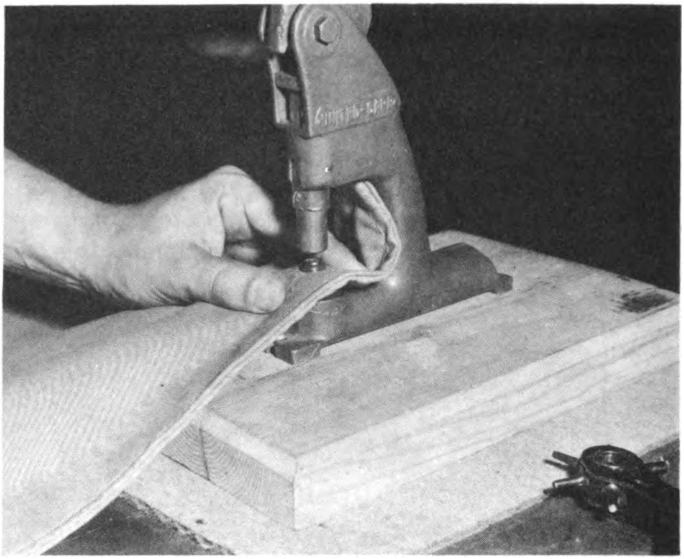


Figure 20. — Setting dura-dot stud and eyelet.

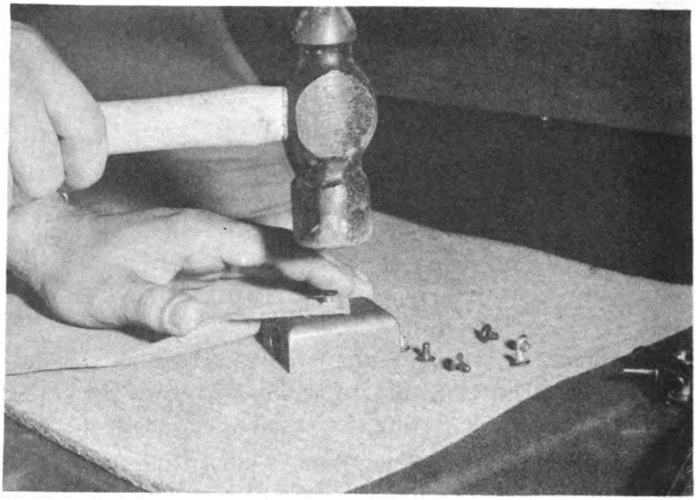


Figure 21. — Setting the speedy rivet.

SPEEDY RIVETS

SPEEDY RIVETS are valuable units for fastening leather, or webbing cloth, or for use wherever a permanent setting is desired. A speedy rivet is used in the crotch strap of the AN-V-18 life vest, in binocular cases for securing straps, and in numerous other locations. These units are available in various sizes, but normally only two sizes are included in the UNITED CARR FASTENER KIT issued by the Navy.

In setting speedy rivets, a hole is made, the rivet-base is inserted through the material, the cap is placed, and with several moderate hammer blows, the job is completed. Setting the speedy rivet is shown in figure 21.

GROMMETS

A GROMMET is nothing more than a reinforcement around a hole. It may be round, square, or oblong in shape, and the material may be metal, rubber, or cloth. The type discussed here, however, is made of metal.

The grommet used in parachute packs is a plain unit of special size, and special dies are used to set it. Figure 22 illustrates this plain grommet and its various popular sizes. Notice that each grommet consists of two parts — GROMMET and WASHER.

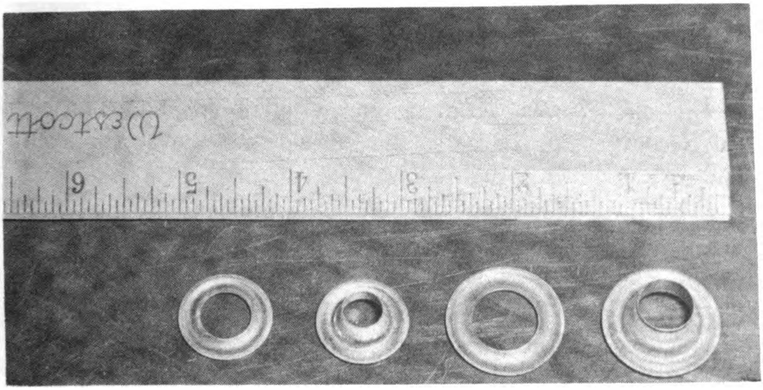


Figure 22. — Plain grommets.

The setting tools used to set this grommet are shown in figure 23.

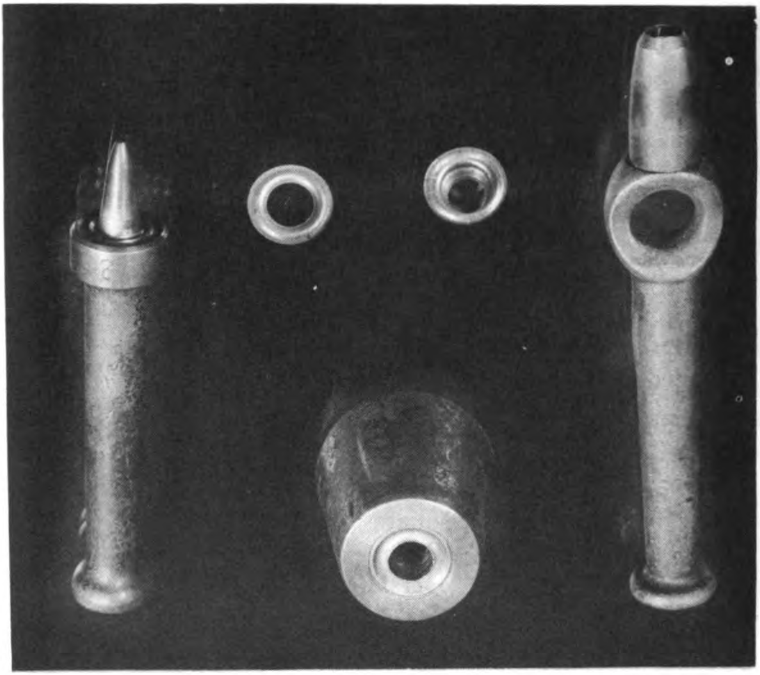


Figure 23. — Grommet setting tools.

SETTING A GROMMET

To set a grommet, use an appropriate-sized grommet punch to cut a hole for the grommet section of the assembly, passing this part through the hole. Insert the washer over the shank and set, as shown in figure 24.

If no press dies are available, the grommet may be set by use of hand tools, in which case a mallet or hammer is used to spread the grommet shank over the inside diameter of the washer, as shown in figure 25.

Make certain that the thickness of the material is appropriate for the size of grommet being used. Do not attempt setting a number "4" grommet in two or three thicknesses of light fabric.

Never attempt setting a grommet with a single blow of the hammer or a quick jerk of the hand-press lever. Such action will split the shank of the grommet and cause a poor setting.

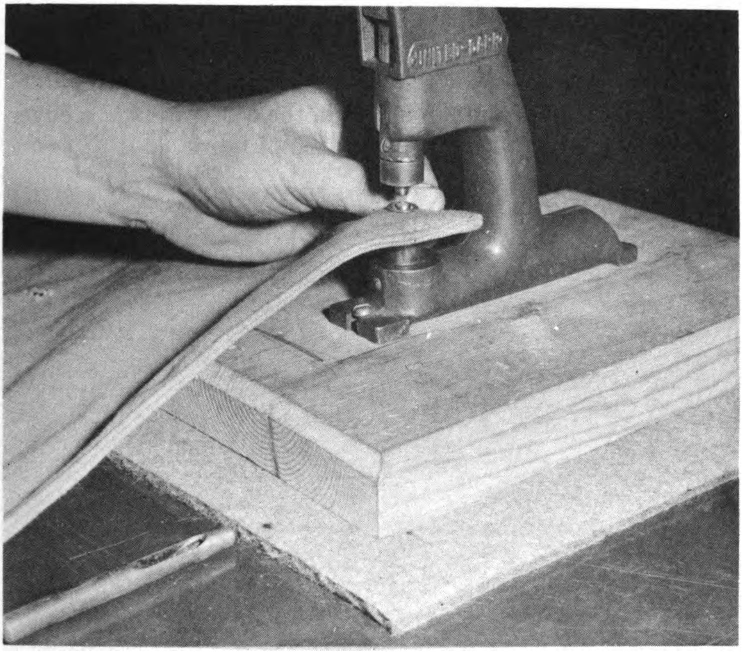


Figure 24. — Setting a grommet by use of hand press.

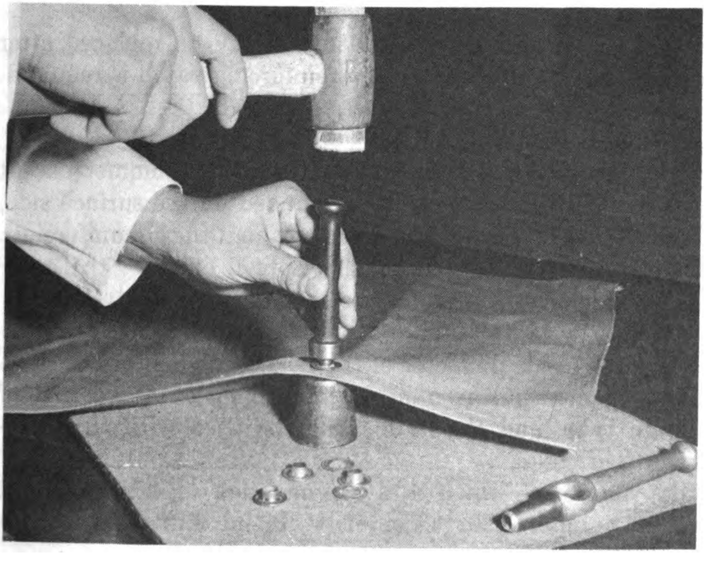


Figure 25. — Setting grommet by hand.

Before beginning pressure or hammering, make certain that the grommet or washer is lying flat and is accurately centered.

Be sure the grommet is reinforced in a heavy hem or patch. Figure 26 illustrates a grommet set in the center area of a cover which is reinforced with a heavy patch of fabric.

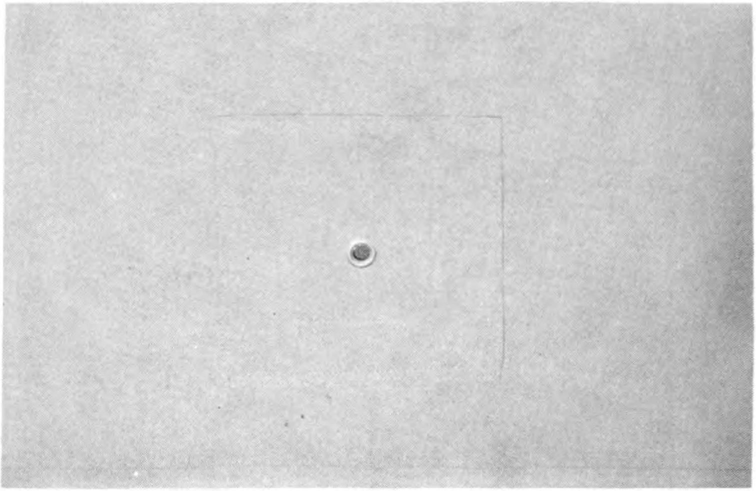


Figure 26. — Grommet set in reinforcing patch.

Before a grommet or other fastener may be replaced after pulling loose, the application of a reinforcing patch is required.

SPUR GROMMETS

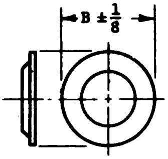
The SPUR GROMMET is similar to the plain grommet except that it is slightly heavier, is more rounded on the surface side, and has a series of sharp teeth arranged about the circumference.

The teeth or spurs of the washer spread out into the outer receiving ridge of the grommet as the entire assembly is set.

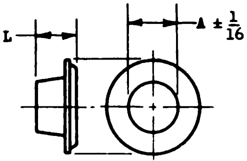
Spur grommets are supplied in many sizes which are governed by the inside diameter of the hole being reinforced.

The grip of a spur grommet is more tenacious than that of the plain type, and the unit should be used with that consideration in mind.

Study figure 27 which is a reproduction of AN Standard Drawing number 230, Grommets Plain and Spur (with washers).



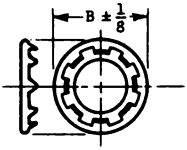
WASHER



GROMMET

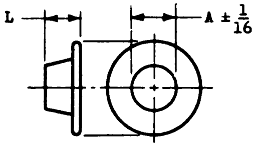
PLAIN GROMMETS

ASSEMBLY DASH NO.			DETAILED PART NO.						TRADE SIZE NO.	A DIA AFTER INSERTION	B DIA	L ±.015	FOR USE WITH MATERIAL THICKNESS MAX
			GROMMET			WASHER							
ALUM	BRASS	STEEL	ALUM	BRASS	STEEL	ALUM	BRASS	STEEL					
A20	B20	F20	GA20	GB20	GF20	WA20	WB20	WF20	00	5/32	7/16	.175	.120
A10	B10	F10	GA10	GB10	GF10	WA10	WB10	WF10	0	1/4	9/16	.200	.160
A1	B1	F1	GA1	GB1	GF1	WA1	WB1	WF1	1	5/16	11/16	.230	.170
A2	B2	F2	GA2	GB2	GF2	WA2	WB2	WF2	2	3/8	27/32	.255	.200
A3	B3	F3	GA3	GB3	GF3	WA3	WB3	WF3	3	7/16	31/32	.335	.280
A4	B4	F4	GA4	GB4	GF4	WA4	WB4	WF4	4	1/2	1-1/16	.370	.300
A5	B5	F5	GA5	GB5	GF5	WA5	WB5	WF5	5	5/8	1-3/16	.380	.300



WASHER

SPUR GROMMETS



GROMMET

ASSEMBLY DASH NO.		DETAILED DASH NO.				TRADE SIZE NO.	A DIA AFTER INSERTION	B DIA	L ±.020	FOR USE WITH MATERIAL THICKNESS MAX
		GROMMET		WASHER						
BRASS	STEEL	BRASS	STEEL	BRASS	STEEL					
BS1	FS1	GBS1	GFS1	WBS1	WFS1	1	5/16	11/16	.275	.100
BS2	FS2	GBS2	GFS2	WBS2	WFS2	2	3/8	27/32	.315	.125
BS3	FS3	GBS3	GFS3	WBS3	WFS3	3	7/16	31/32	.330	.130
BS4	FS4	GBS4	GFS4	WBS4	WFS4	4	1/2	1-1/16	.405	.175
BS5	FS5	GBS5	GFS5	WBS5	WFS5	5	5/8	1-3/16	.455	.225

THE ASSEMBLY SHALL CONSIST OF ONE GROMMET AND ONE WASHER OF THE SAME MATERIAL.
MATERIAL: BRASS, ALUMINUM OR STEEL.
③ FINISH: STEEL, CADMIUM PLATE, SPEC AN-P-61.
EXAMPLES OF PART NO.: AN230A10 =NO. 0 SIZE PLAIN GROMMET ASSEMBLEY, ALUMINUM.
AN230GA10=NO. 0 SIZE PLAIN GROMMET ALUMINUM.
AN230WA10=NO. 0 SIZE PLAIN GROMMET WASHER, ALUMINUM.
SPUR GROMMET ARE FOR USE IN WITHSTANDING HIGHER TEARING LOAD THAN THE PLAIN GROMMET, PARTICULARLY IN LOOSELY WOVEN FABRIC.
COMMERCIAL PRODUCTS.
DIMENSIONS IN INCHES.

APPROVED 26 Sep 42 REVISED ① 15 Apr 43 ② 13 Jul 44 ③ 27 Nov 44

PROCUREMENT SPECIFICATION	ARMY-NAVY AERONAUTICAL STANDARD	AN230
NONE	GROMMETS - PLAIN AND SPUR (WITH WASHERS)	

Figure 27. — Grommets, plain and spur.

The setting operation for spur grommets is no different from that for plain grommets. However, different dies should be used, since the spur grommet is more rounded on the surface and slightly larger on the outside circumference. The "well" is deeper in hand and press dies for the spur grommet than for the plain type. Consequently, spur grommet dies should not be used when setting plain grommets, and vice versa.

QUIZ

1. What two types of slide fasteners do we have in the Navy?
2. What is the purpose of the small clips at the top and bottom of slide fasteners?
3. If the slide does not operate freely what should be done?
4. What chemical is recommended for cleaning zipper teeth?
5. How should the zipper be lubricated?
6. To remove the pull tab use two pairs of pliers, one on each side, and (twist at right angles) (twist in opposite directions) (give a quick jerk).
7. When shortening a zipper the chain should be about (1/4) (1/3) (1/2) (1) inch shorter than the opening in the material or garment.
8. When sewing a zipper always (stretch the zipper and not the material) (stretch the material and not the zipper) (stretch both the material and the zipper).
9. Of what use is a bent-tip awl in repairing zippers?
10. What type of fastener is most popular for parachutes?
11. (a) What is a grommet?
    (b) What is its shape?
    (c) What are the two parts of a grommet?
12. If a grommet or fastener has pulled loose what should be done before it is replaced?

CHAPTER 2

SEWING MACHINES

You will be called upon to perform an enormous quantity of repair work, and repair work means sewing, which, in turn, requires a thorough understanding of the specialized tools of parachute repair equipment.

Parachute sewing equipment consists of sewing palms, needles, awls — and sewing machines, which are your silent partners.

TYPES AND CLASSES

In general, there are two types of sewing machines used in the repair and manufacture of Navy parachutes, referred to simply as HEAVY-DUTY and LIGHT-DUTY machines. Both types are operated by electric motors and are fitted with rheostats, or special clutch arrangements, that enable the operator to control the speed.

While there are but two general types, there are several different classes of sewing machines used in parachute repair work. The following list classifies all varieties of sewing machines:

112W115
112W116
111W150
144W202
143W1
L11WSV67
143WSV8
144WSV36
31–15
31–47
97–10

NEEDLES

It may be surprising to learn that a needle is a fairly complicated instrument. Actually, a needle consists of seven different and distinct parts, as may be seen in figure 28.

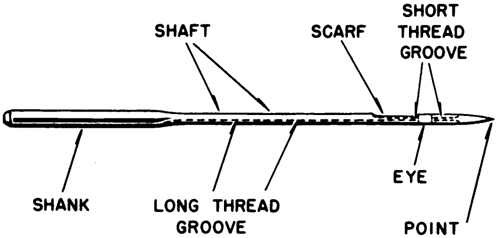


Figure 28. — The parts of a needle.

Needles are ordered according to SIZE, CLASS, and VARIETY, and all three descriptions must accompany QUANTITY in all orders.

CLASS and VARIETY deal with the diameter of the shank and the distance from the shank to the eye. For a given machine, class and variety usually remain constant, regardless of size.

SIZE deals with the eye-degree. The larger the number of the needle, the larger the eye.

For any given job, the needle-size must be determined by the size of the thread to be used, since the needle size must be such that the thread will pass freely through the eye. Table I will supply ready data for determination of needle sizes for threads of given size.

To set the needle in your machine, turn the balance wheel over until the needle-bar moves up to its highest point. Loosen the set screw in the needle-bar and insert the needle into the bar as far as it will go. The long groove should face AWAY from the sewing hook.

THREAD

The majority of parachute work is performed with either silk or cotton thread. Cotton thread sizes are numbered, but UNLIKE NEEDLE SIZES, THE LARGER NUMBERS IDENTIFY THE SMALLER THREADS.

Silk thread sizes range from 00 (small) through A, B, C, D, E, and F, each letter signifying a progressively larger size.

According to its manufacture, thread is either LEFT TWIST or RIGHT TWIST. It is important that LEFT TWISTS ONLY be used for the needle, while either left or right twist thread may be used for the bobbin.

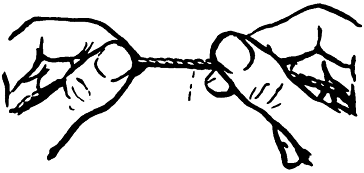


Figure 29. — How to determine the twist.

To test for twist, hold the thread as indicated in figure 29, turning the thread toward you with the right hand. If the thread is left twist, the strands will tighten, while if it is right twist, the strands will tend to loosen.

TABLE I — Corresponding thread and needle sizes.

Sizes of Needles	*Sizes of Thread*	
	Cotton	*Silk*
12	**70 or 80**	**00 or 0**
14	**60 or 70**	**0 or A**
16	**40 to 60**	**A or B**
18	**30 to 40**	**B or C**
20	**24 or 30**	**D or E**
22	**16 or 24**	**E or F**

THE BOBBIN

A sewing machine uses two separate threads. One thread comes from the spool down through the needle's eye, the other from the bobbin. In making a stitch, these two threads must become interlocked.

The BOBBIN is a type of reel on which the thread is wound. When all thread wound on the bobbin has been exhausted, the

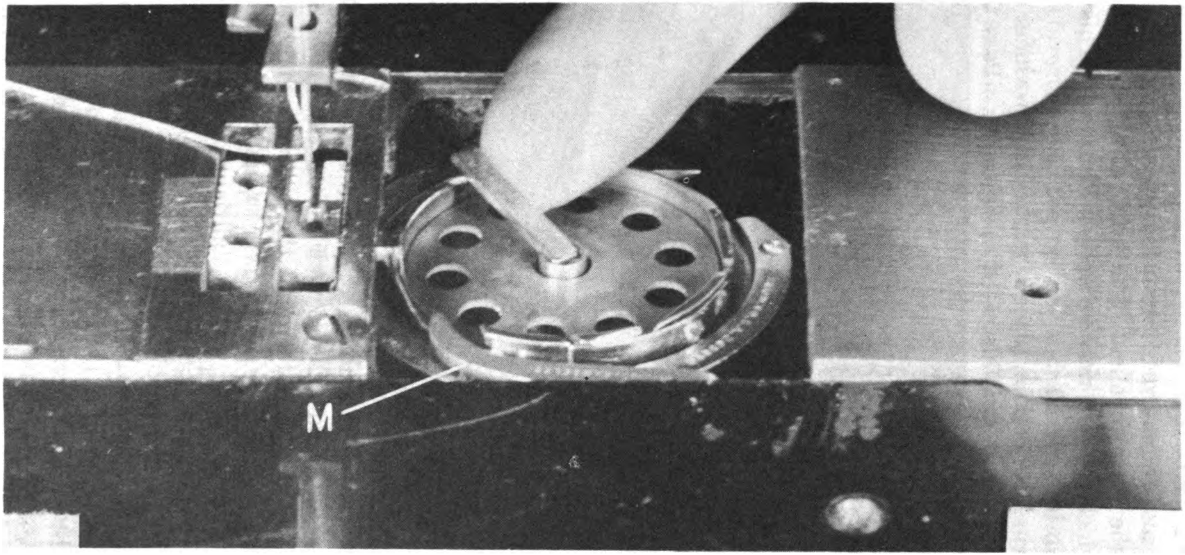


Figure 30. — Removing the bobbin.

unit must be taken out and rewound — an operation called "winding the bobbin."

Bobbins are removed from most types of sewing machines in much the same manner. The latch of the bobbin is raised, after which the unit may be freely withdrawn. This operation is shown in figure 30.

To wind the bobbin, place it in the bobbin-winder spindle as far as it will go, as illustrated in figure 31. Pass the thread down through the thread guide (A) in the tension bracket, drawing it behind and between the tension discs (2). Wind the end of the thread around the bobbin several times, then push the pulley of the bobbin winder against the machine belt, and start the machine. When sufficient thread has been wound on the bobbin, the pulley will automatically fall away from the belt, and the bobbin winder will stop.

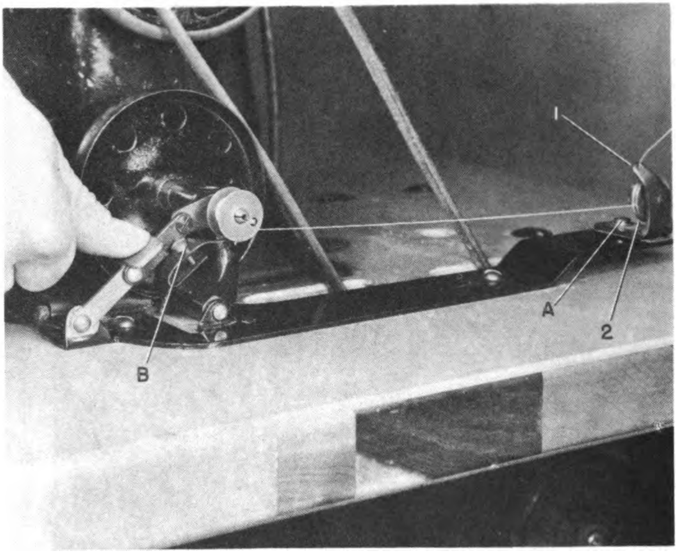


Figure 31. — Winding the bobbin.

If the thread does not wind evenly on the bobbin, loosen the screw (A) in the tension bracket and move the bracket to the right or left as required. When the adjustment is satisfactory, again tighten the screw.

The amount of thread that will wind on the bobbin is regulated by means of the screw (B). To wind additional thread, turn the screw (B) so that it advances DOWNWARD. To wind less thread, turn screw (B) so that it moves UPWARD. Bobbins may be wound while material is being stitched on the machine.

THREAD TENSION

In the correct stitch, the needle- and bobbin-thread should be locked midway between the exposed surface of the material as may be seen in the sectional view of figure 32.

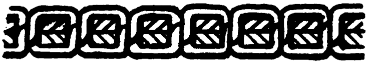


Figure 32. — The perfect stitch.

If the tension on the needle-thread is too great, or if the tension on the bobbin-thread is not sufficient, the needle-thread will lie in a straight line along the upper surface of the material, as shown in figure 33.

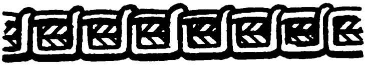


Figure 33. — Taut needle-thread tension.

If the tension on the bobbin is too great, or if tension on the needle-thread is not great enough, the bobbin-thread will lie in a straight line along the underside of the material as pictured in figure 34.

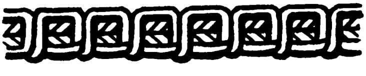


Figure 34. — Loose needle-thread tension.

Never attempt adjusting the upper tension when the presser lifter is UP, as the tension will have already been released.

If the tension is not correctly adjusted, if the discs are clogged with lint, or if the thread-controller spring does not have proper tension, the machine will not function properly. Malfunction may also result if the thread is too coarse or too fine for the throat plate, or if the needle is bent or blunt. Always make certain that the needle is inserted to its full length, and that it is straight.

LUBRICATION

When the sewing machine is in continuous use, IT SHOULD BE OILED AT LEAST TWICE DAILY. Oil should be applied at all points designated as well as to all other parts in movable contact.

OIL SHOULD NEVER BE APPLIED TO THE PRESSER-BAR CLUTCH CLAMP ON THE CLASS 97 SEWING MACHINE!

The small green felt pad in the hook assembly, shown in figure 35, should be kept saturated with oil in order to lubricate the hook race. When this pad is so saturated, it appears nearly black in color, fading to a light green as the pad dries.

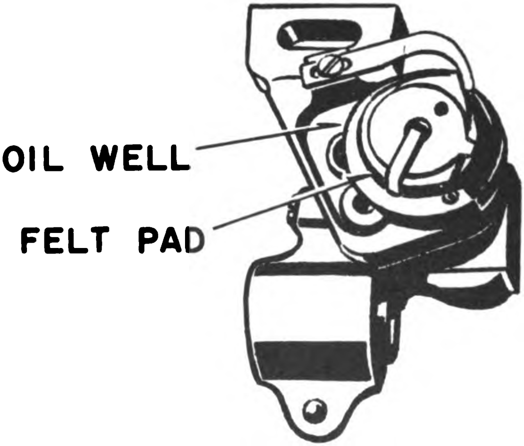


Figure 35. — Hook lubrication.

TROUBLE SHOOTING

The data contained in the next few pages has been arranged to enable you to locate and eliminate small operational troubles quickly.

If the machine RUNS HARD, check for the following:

Lack of oil.
Thread wound around balance-wheel hub and motor shaft bearing and pulley.
Oil and dirt in bearings.
Tight bearings.
Belt too tight.

In the case of LOOPED STITCHES ON THE TOP OF MATERIAL, check for:
Upper tension too tight, or lower tension too loose.
Bobbin case incorrectly threaded.
Dirt or lint in upper tension disc.
Dirt, lint, or thread under bobbin tension spring.
Thread wound around bobbin case.

In case of LOOPED STITCHES ON THE LOWER SIDE OF MATERIAL, check for:
Upper tension too loose, or lower tension too tight.
Incorrectly threaded machine.
Dirt or lint in upper tension discs.
Dirt, lint, or thread under bobbin tension spring.
Thread wound around bobbin case.

If SKIPPED STITCHES are the trouble, check for:
Bent needle.
Needle too small for thread.
Needle set too high or too low.
Needle set backwards.
Needle incorrectly threaded.
Needle too long or too short.
Hook point blunt or worn.

If STAGGERED STITCHES become evident, check for:
Too little pressure on presser foot.
Thread-controller spring weak, broken, or missing.
Incorrect adjustment of thread-controller spring.

When stitches are of UNEVEN LENGTH, check for:
Improper pressure on presser foot.
Feed dog improperly adjusted.
Dirt around feed mechanism.

If the UPPER THREAD PERSISTS IN BREAKING, check for:
Poor, knotty, or rotten thread.
Machine incorrectly threaded.
Needle set backward, too high, or too low.
Bent needle, or needle too fine for thread.
Needle rubbing against presser foot, throat plate, or hook.
Rough or sharp places on hook or eye of needle.
Upper tension too tight.

In case the LOWER THREAD BREAKS, check for:
Poor, knotty, or rotten thread.
Lower tension too tight.
Bobbin case incorrectly threaded.
Burrs or sharp edges on hook or throat plate.
Bobbin too loosely or tightly wound.
Bobbin too full or unevenly wound.
Rough or sharp edges on bobbin shoulders or tension spring.
Dirt or lint packed in hook race or bobbin case

If the MATERIAL IS FEEDING INCORRECTLY, check for:
Stitch regulator disengaged.
Dirt around feeding mechanism.
Incorrect setting of feed dog.
Bent presser foot or feed dog.
Feed dog loose.

When the BOBBIN WILL NOT WIND CORRECTLY, check for:
Thread guide out of line, piling thread on one side of bobbin.
In case the MACHINE RUNS NOISILY, it may be due to:
Lack of oil.
Too much tension.
Loose bearings or other parts.

When PUCKERS APPEAR IN THE MATERIAL, check for:
Seam puckers — one or both tensions too tight.
Side puckers — dull needle.
In case the NEEDLE PERSISTS IN BREAKING, check for:
Pulling material while stitching.
Needle too long or set too low.
Presser foot or feed dog out of line.
Failure to raise the needle before removing material.

The material discussed in the preceding pages is of a general nature applicable to ANY sewing machine.

SEWING MACHINE — 112W115

The Model 112W115 sewing machine, shown in figure 36, has two needles and two belt-driven rotary hooks, and produces a 301-type lock stitch. It has a compound feed which consists of a combination of drop-feed and needle-feed, and is used for sewing diagonal seams on parachute canopies and for sewing light fabric and medium-weight canvas where two rows of stitching are required. The maximum speed recommended for Machine 112W115 is 3,000 stitches per minute.

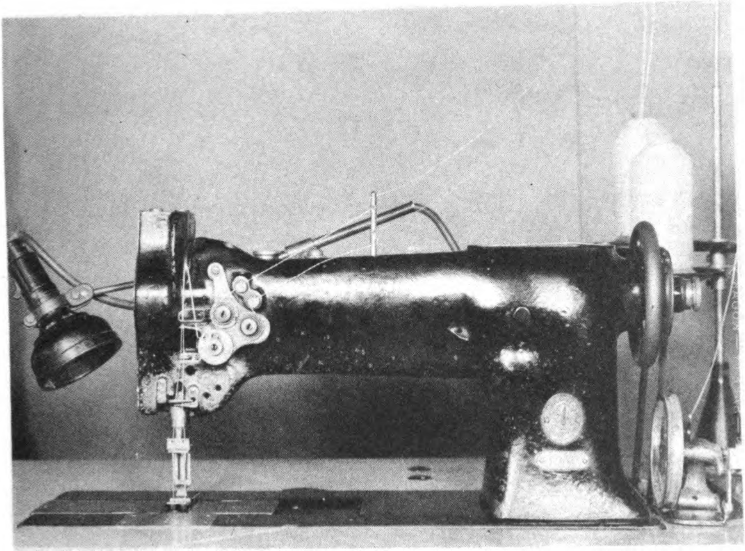


Figure 36. — Sewing machine 112W115 (front view .

TO REPLACE THE BOBBIN AND THREAD THE BOBBIN CASE ON THE 112W115 MACHINE, hold the bobbin between the thumb and forefinger so that the thread draws off the bottom of the bobbin from left to right, as shown in figure 37. Place the bobbin on the center stud of the bobbin case, then push down latch (C), illustrated in figure 38. Draw the thread into slot (1) and under the back of protection (2), leaving a loose end of thread about two inches long. Next, close the bed slide.

TO THREAD THE OUTBOARD NEEDLE, pass the thread from the left spool on the spool-stand through the left guide at the top of the spool-stand. Pass the thread back to the front through hole (1), shown in figure 39, in the pin on the top of the machine, and from right to left through hole (2). From that point, pull

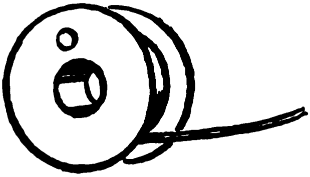


Figure 37. — Direction of thread off bobbin.

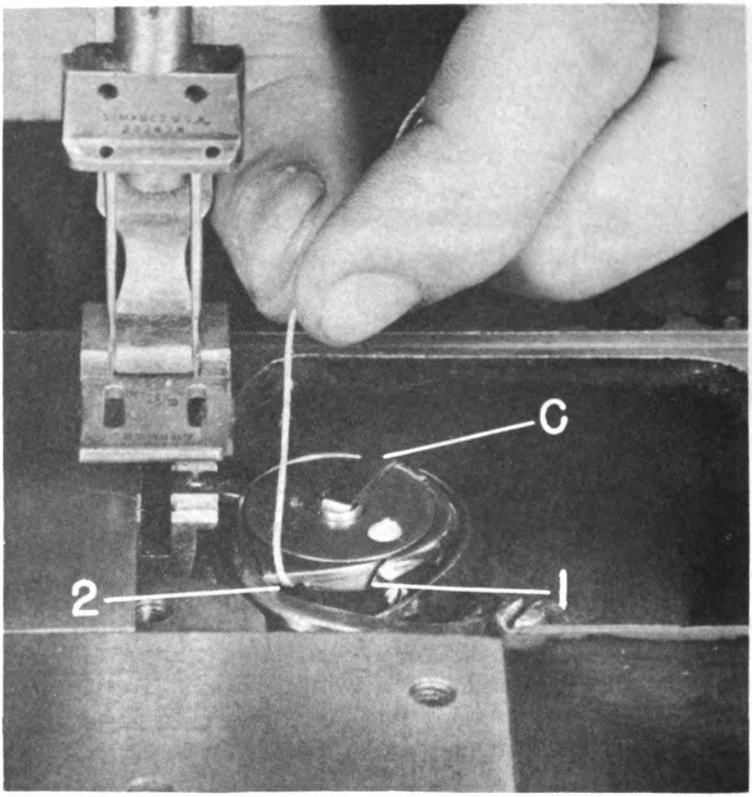


Figure 38. — Bobbin case threaded.

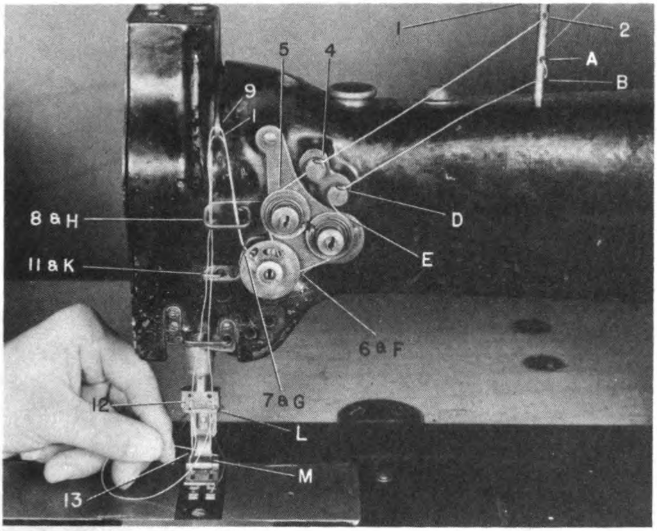


Figure 39. — Threading the needles.

the thread through the upper thread retainer (4), between the left-tension discs (5), under and around the thread-controller (6), into the thread-controller spring (7), up through the thread-guide (8), upward and from right to left through the upper hole (9), into the end of the thread take-up lever, down again through thread-guide (8), through thread guide (11), downward through the left hole (12) in the needle-holder, and from right to left through the eye of the left needle (13).

To THREAD THE INBOARD NEEDLE, pass the thread from the right spool on the spool-stand through the right guide at the top of the spool-stand. Then pass the thread (see figure 39) from back to front through hole (A), located in the pin on top of the machine, and from right to left through hole (B). Pull the thread thence through the lower thread retainer (D), under and between the right tension-discs (E), under and around the thread-controller (F), into the thread-controller spring (G), up through thread-guide (H), upward and through hole (I) in the end of the thread take-up lever, down again through thread-guide (H) and thread-guide (K), down through hole (L) in the

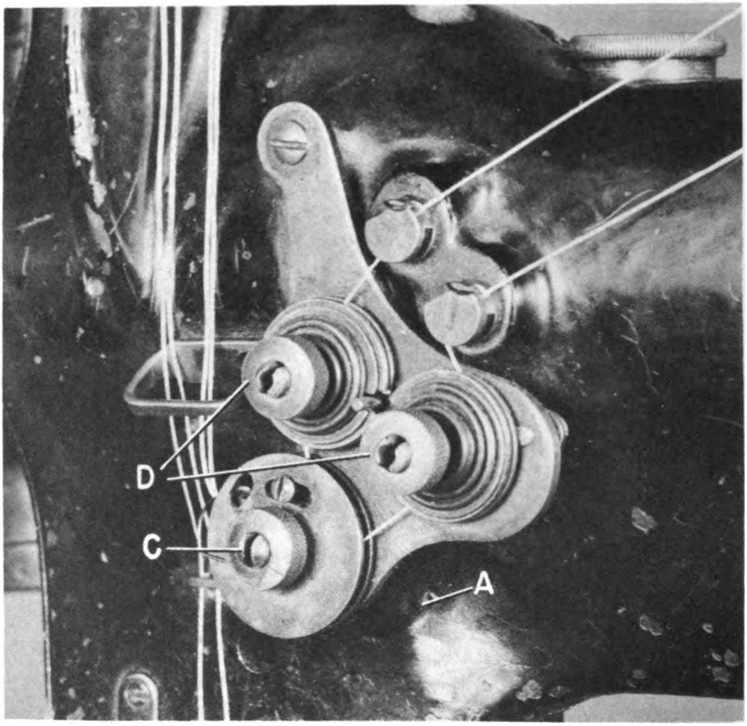


Figure 40. — Thread-controller and thread-tension adjustments.

needle-holder, and from left to right through the eye (M) of the inboard needle.

To regulate tensions, adjustments are made with the thumb-nuts (D), shown in figure 40. These nuts are located on the tension studs. To increase tension, turn in a clockwise direction, and to decrease the tension, turn counterclockwise.

The tension on each of the bobbin threads is regulated by means of the screw nearest the center of the tension spring located on the outside of the bobbin case. To increase the tension, turn the screw clockwise, and to decrease the tension, turn counter-clockwise.

Pressure on the material is regulated by the screw (F) (shown in figure 41) located on the back of the machine and acting on a flat spring. To increase the pressure, turn this screw so that it moves downward. Turning the screw so that it moves upward decreases the pressure. Pressure should be just heavy enough to enable the feed to move the work along evenly.

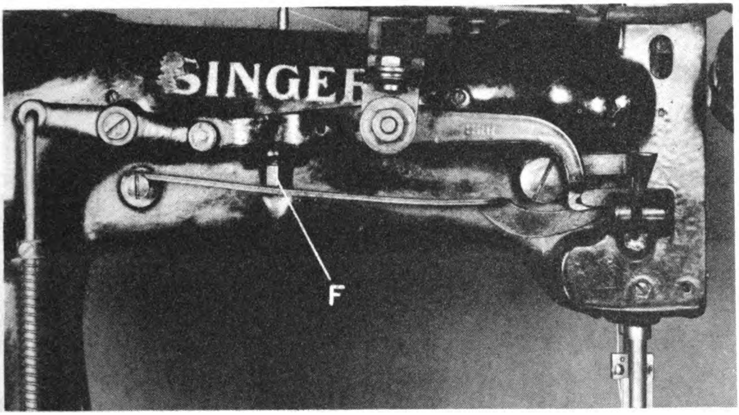


Figure 41. — Regulation of pressure on material.

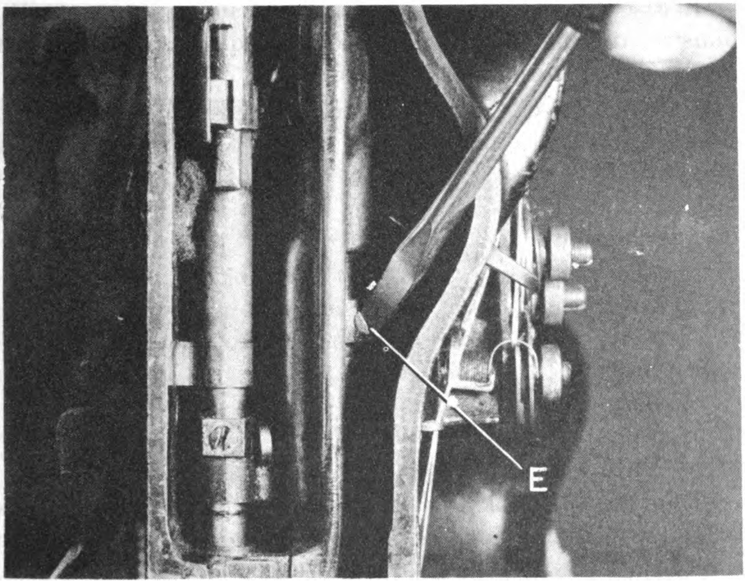


Figure 42. — Needle-bar connecting stud pinch-screw.

THE FUNCTION OF THE THREAD-CONTROLLER SPRING is to hold back the slack of the needle threads until the eye of each needle almost reaches the material in its descent. Without this controlling action, the slack of the thread may be penetrated by the point of the needle as the needle is descending. This is especially true of silk thread.

It is sometimes found advisable to increase the tension of the controller-spring when using coarse thread, and to decrease the tension when using fine thread.

To increase the tension of the controller on the threads, loosen the tension stud screw (A) (shown in figure 40). Turn the tension stud (C) slightly to the left. To decrease the tension, turn the tension stud to the right, then re-tighten the stud set-screw (A).

IN SETTING THE NEEDLE-BAR, first see that the needles are inserted completely into the holder. There are two lines across the needle-bar, about two inches above the lower end. When the needle-bar is at its lowest position, the upper mark should be barely visible at the end of the needle-bar rock frame.

In case the needle-bar is incorrectly set, loosen the screw (E), illustrated in figure 42, and place the needle-bar in the correct position. Next, retighten the screw.

To set a needle-bar containing no mark, first adjust the stitch-regulator to indicate zero stitches to the inch, then set the needle-bar so that when it rises 3/32-inch from its lowest position, the points of the sewing hook will be at the center of the needle, and about 1/16-inch above the eye of the needle.

TO TIME THE SEWING HOOKS, turn the balance wheel toward you until the needle-bar has descended to its lowest point and has risen until the lower timing mark across the needle-bar is barely visible at the end of the needle-bar rock frame. Loosen the four screws (T) (shown in figure 43) in the hook pinion gears. Turn the sewing hooks until the point of each hook is at the center of its needle, then tighten the four screws securely.

To prevent the points of the hooks from dividing the strands of the threads, the hooks should run as close as possible to the needles. TO SET THE SEWING HOOKS TO OR FROM THE NEEDLES, turn the balance wheel toward you until the points of the sewing hooks are at the center of the needles. Loosen the four screws (Q), (R), (S), and (V), shown in figure 43. These screws are beneath the bed of the machine in the hook saddles. Move

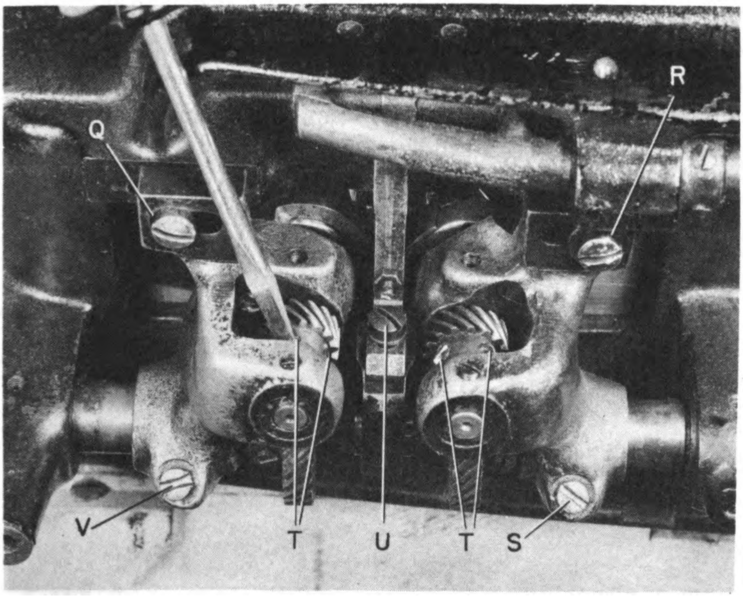


Figure 43. — Adjustment of hook saddles.

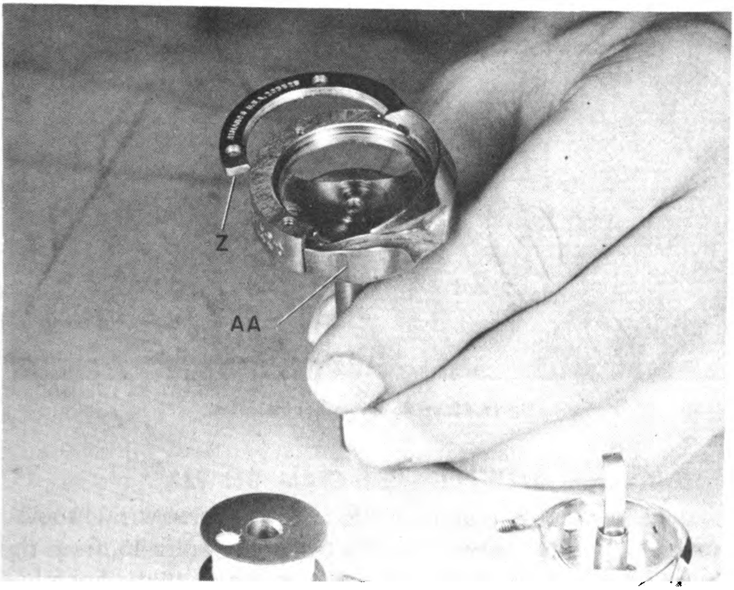


Figure 44. — Sewing hook removed from machine, showing hook washer and bobbin-case assembly.

the hook saddles to the right or left as required, until the points of the hooks are almost touching the needles, then tighten the four screws.

It may become necessary to re-time the sewing hooks due to movement of the hook saddle.

The function of the hook guard washer (AA) in figure 44, is to prevent the point of the hook from striking the needle. This might otherwise occur when the needle is deflected as it passes through the material.

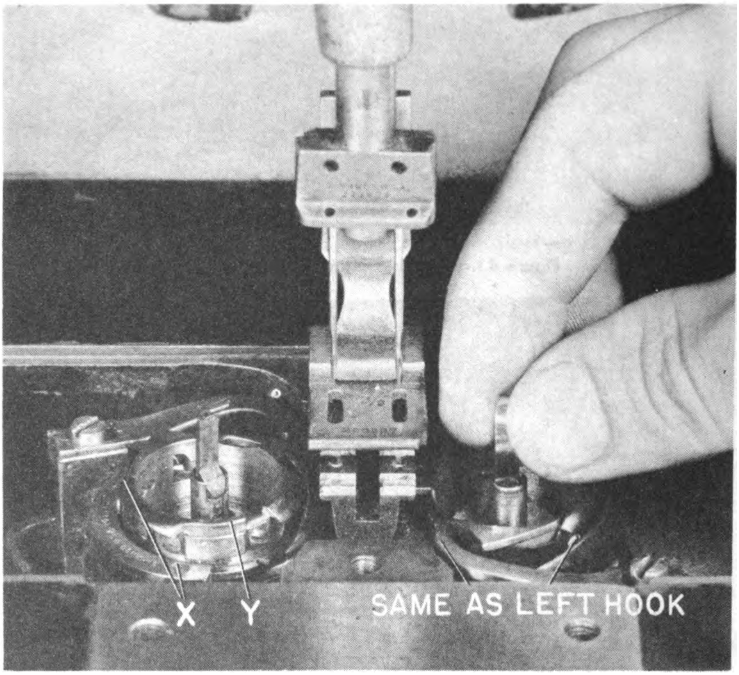


Figure 45.— Removing bobbin cases.

To remove the bobbin cases from the sewing hooks, remove the four gib screws, shown as (X) in figure 45, from the sewing hooks. Lift off the gibs, (Z) in figure 46, and remove the bobbin cases, which are marked as (Y) in figure 45.

When the feed dog is at its highest position, it ordinarily should show a full tooth above the throat plate. To RAISE OR LOWER THE FEED DOG, remove the throat plate and replace after cleaning the lint and dust from between the feed points. Tip the machine backward and turn the balance wheel toward you until the feed dog is at its highest position. Loosen screw (U), figure 43, in the feed-lifting cam fork and raise or lower the feed dog as required.

When adjusting the feed dog, be careful that its underside does not drop low enough to strike the sewing hooks.

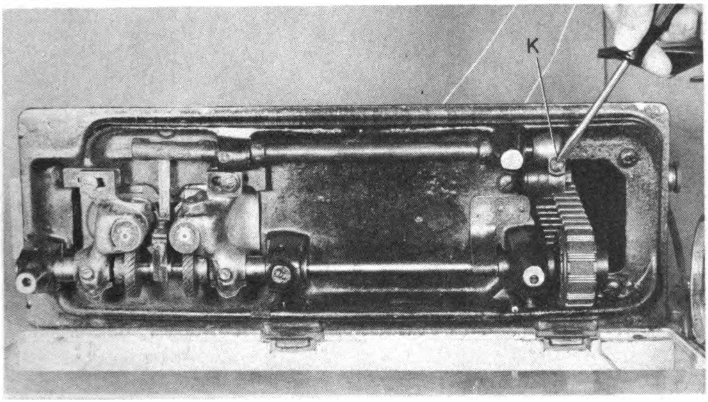


Figure 46. — Feed-dog adjustment.

The feed dog should be set so that when the needles are down, the centers of the needle-holes are slightly in back of the needles. If the needles do not enter the holes in the feed dog, loosen the pinch screw, (K) in figure 46, and adjust the mechanism as required.

SEWING MACHINE — 111W150

The *111W150* SEWING MACHINE, illustrated in figure 47, is a high-speed, single-needle, lock-stitch, compound feed machine employing a belt-driven rotary hook with a vertical axis. It is designed for stitching light to heavy fabrics, and is used for

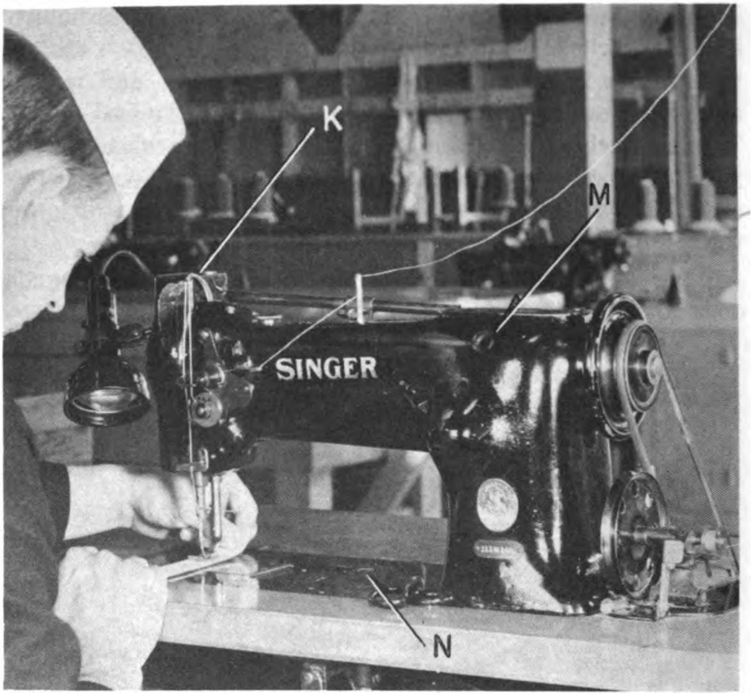


Figure 47. — Front view of Sewing Machine 111W150, showing adjustments.

canopy repairs where a single-needle machine is applicable. It is also used for repairing flight clothing and in the manufacture and repair of canvas aviation gear.

The maximum speed recommended for this machine is 3500 RPM. When the unit is in operation, the balance wheel turns so that the top of the wheel moves toward the operator.

REPLACEMENT OF THE BOBBIN AND THREADING OF THE BOBBIN CASE demands the same procedure as for Machine 112W115, just discussed.

The procedure for THREADING THE NEEDLE, as illustrated in figure 48, is as follows. Pull the thread from the unwinder on top of the machine, and pass the thread through the lower hole (1), from back to front, and through the upper hole (2), from right to left. Pull the end down through hole (3), up through hole (4), and down through hole (5). Then pass the thread between the tension discs (6), from right to left around the thread-controller (7), into the thread-controller spring (8), up through thread-guide (9), from right to left through hole (10), and into the thread take-up lever.

From the thread take-up lever, pass the thread down through the thread-guide (11), through thread-guides (12), (13), and (14), and from left to right through the eye (15) of the needle.

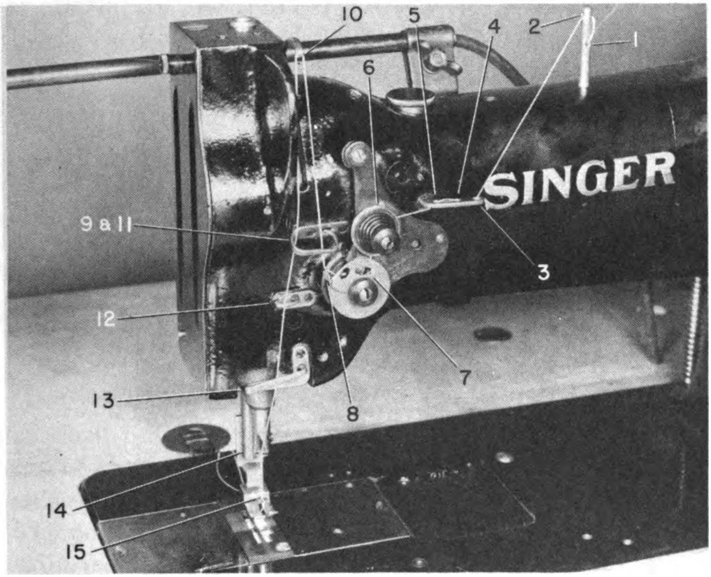


Figure 48. — Threading the needle.

TENSION ON THE NEEDLE-THREAD IS REGULATED BY THE THUMB NUT (0) in figure 49. To increase the tension, turn this nut in a clockwise direction, and counter-clockwise to decrease the tension.

TENSION ON THE BOBBIN-THREAD IS REGULATED BY MEANS OF THE SCREW nearest the center of the tension spring on the outside of the bobbin case. This screw turns clockwise to increase the tension, and counter-clockwise to decrease the tension.

PRESSURE ON THE MATERIAL IS REGULATED BY THE SCREW shown as (F) in figure 50. This screw acts on a flat spring, and is turned so that it moves downward to increase pressure, while to decrease pressure, the screw is turned to move upward. Pressure should be sufficient to enable the feed to move the material along evenly.

For greater controller action on the thread, loosen the stop screw (S), as seen in figure 49, and set the stop to a lower position. For less action, set the stop higher.

In figure 49, (T) denotes the tension stud screw which controls the action of the controller-spring on the thread. To strengthen the action of the controller-spring on the thread, loosen the tension stud screw (T), and turn tension stud (R) slightly counter-clockwise with a screwdriver. To lighten its action, turn the stud (R) clockwise.

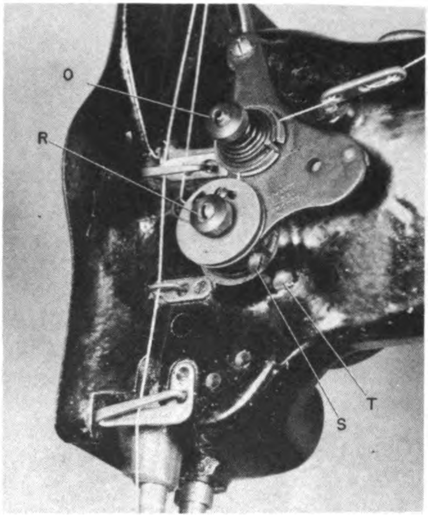


Figure 49. — Adjustment of thread-controller.

To SET THE NEEDLE-BAR, see that the needle is inserted in the bar as far as it will go. Two lines run across the needle-bar about two inches above the lower end, and when the needle-bar is at its lowest position, the upper mark should be barely visible at the end of the needle-bar rock frame.

If the needle-bar is incorrectly set, loosen the needle-bar connecting stud pinch screw, designated as (E) in figure 50, and correctly place the bar as described in the preceding paragraph.

To set a needle-bar containing no mark, set the feed eccentric so that no feeding motion is present, then set the needle-bar so that when it rises 3/32-inch from its lowest position and the point of the sewing-hook is at the center of the needle, the needle eye will be about 1/16-inch below the hook point.

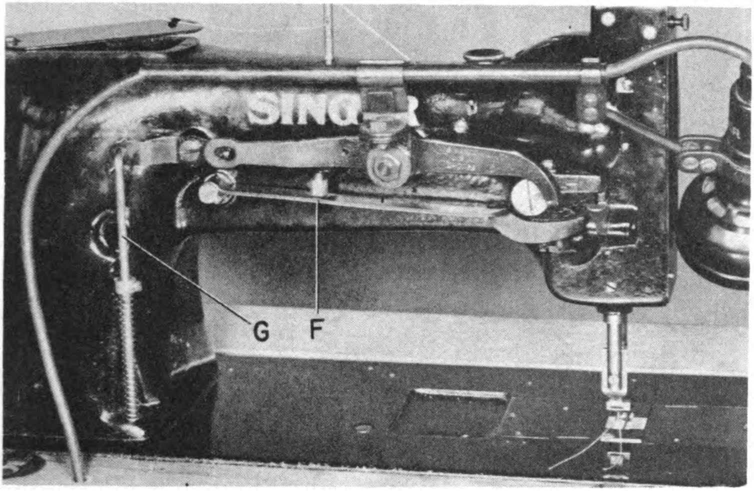


Figure 50. — Regulation of pressure on material.

The needle-bar should be set so that when the feed eccentric is adjusted for zero feeding movement, the distance between it and the presser-bar will be 17/32-inch.

If the needle-bar is incorrectly set in the feed-dog needle hole, adjust the feed eccentric for zero feeding movement, then loosen the clamp screw in the crank (W) of figure 52. Also loosen the screw located in the hole, (G) of figure 50. Center the needle with the feed dog, and see that crank (W) is parallel with the top surface of the bed.

If, with zero feeding movement, the needle-bar is not the proper distance from the pressure-bar, loosen the clamp screw, (V) in figure 52, and set the needle-bar 17/32-inch from the presser bar. A piece of sheetmetal 17/32-inch wide may be used as a gauge for determining the correct distance.

To TIME THE FEEDING HOOK, set the feed eccentric so that

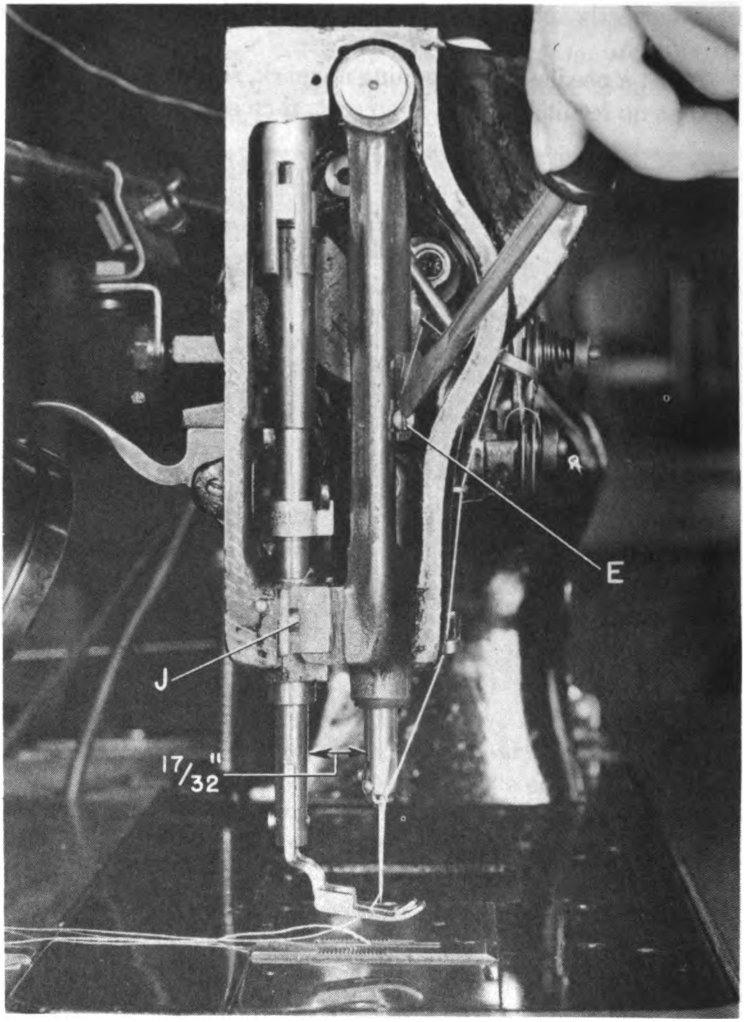


Figure 51. — End view of machine showing adjustments.

there is no feeding motion. Remove the throat plate and turn the balance wheel toward you until, on the upward stroke of the needle-bar, the lower mark across the bar is just visible at the end of the needle-bar rock frame. If the needle-bar and sewing-hook are correctly timed, the point of the hook will be at the center of the needle and about 1/16-inch above the eye.

If the point of the hook is not at the center of the needle, or is not 1/16-inch above the eye, loosen the two screws in the hook pinion gear, (Y) of figure 52, and turn the sewing hook until the point of the hook is at the center of the needle. Then securely tighten the two screws in the gear.

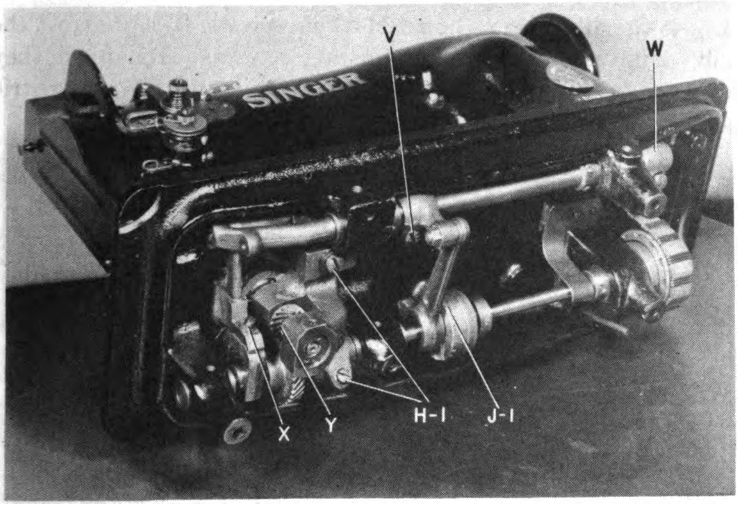


Figure 52. — Adjustment of hook saddle.

To SET THE SEWING-HOOK TO OR FROM THE NEEDLE, turn the balance wheel toward you until the point of the sewing hook is at the center of the needle. Loosen the two screws, marked as (H1) in figure 52, and move the hook saddle to the right or left as required until the point of the hook is as close to the needle as possible without striking.

Sometimes the needle is deflected by the material as it passes through the material. The needle is then prevented from striking the point of the hook by the hook guard-washer (AA) in figure 54.

Usually, when the feed dog is at its highest position, it will show a full tooth above the throat plate. To adjust, remove the throat plate and clean the lint and dust from between the feed points. Tip the machine backward and turn the balance wheel toward you until the feed dog is at its highest position. Loosen the screw (X), figure 52, which is located in the feed-lifting cam fork on the feed bar. Raise or lower the feed dog, as required, taking care that the underside of the dog does not drop too far and strike the sewing hook.

The FEED ECCENTRIC is provided with a gib, as shown in (B1) of figure 53, which can be adjusted to take up any wear or loose motion between the feed eccentric and the eccentric body. To adjust the gib, loosen the two locking screws, (C1), nearest the gib, and tighten the two adjusting screws, (D1), until they bear against the gib so that all play is eliminated. The eccentric will then fit snugly into the slot in the eccentric body.

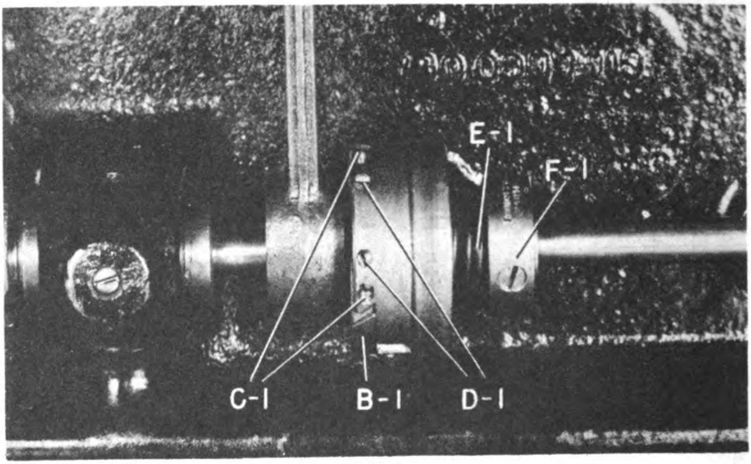


Figure 53. — Feed eccentric.

The spring, (E1) in figure 53, presses against the feed eccentric cam and prevents the cam from moving out of position while the machine is in operation. Spring pressure may be changed by moving the collar (F1) to the right or to the left. The collar is ordinarily set flush with the end of the hub of the eccentric body.

To adjust the STITCH-LENGTH INDICATOR, set the machine to produce eight measured stitches to the inch, then loosen the set screw in the stitch-indicating disc, (M) in figure 47. Press down on the plunger (N) in the bed of the machine. With the plunger down, turn the balance wheel slowly until the plunger

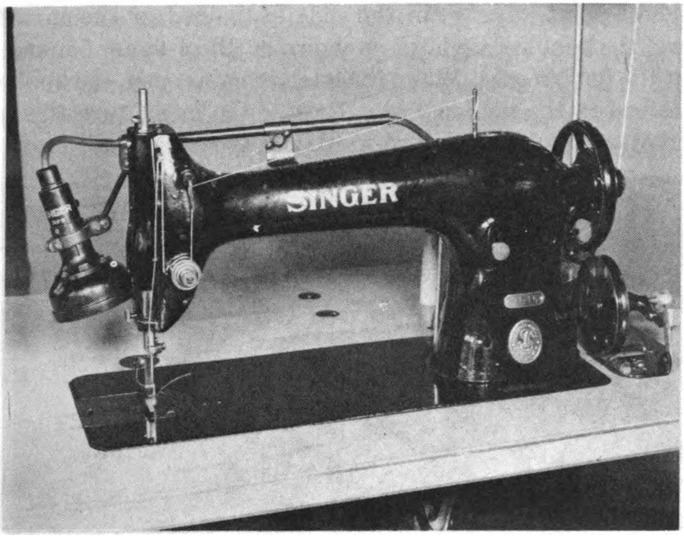


Figure 54. — 31-15 sewing machine.

enters the notch (J1) shown in figure 52 in the adjustable-feed eccentric cam. The stitch-indicating disc, (M) of figure 47, should be so set that the figure 8 can be seen through the hole in the front of the arm.

To REMOVE THE NEEDLE-BAR ROCK FRAME ROCK SHAFT, swing the face-plate upward to remove the screw (J), shown in figure 51. Also remove the position bracket. Loosen the set screw, (K) in figure 47, and remove the rock frame hinge stud. Then loosen the clamp screw, (G) of figure 49, and draw out the rock shaft.

SEWING MACHINE — 31-15

The *31-15* SEWING MACHINE, illustrated in figure 54, is a single-needle, lock-stitch machine used for repairing parachute canopies and for making repairs to light- and medium-weight flight clothing. It is also used for repairing and manufacturing light- and medium-weight canvas articles used in Naval Aviation.

The maximum speed recommended for this machine is 2200 stitches per minute.

To REMOVE THE BOBBIN CASE on this machine, turn the balance wheel toward you until the needle moves up to its highest point. Draw out the slide in the bed of the machine, open the bobbin-case latch as shown in (2) of figure 55, and lift out the bobbin case. While the latch remains open, the bobbin is retained in the bobbin case. Release the latch, turn the open end of the bobbin case downward, and the bobbin will drop out.

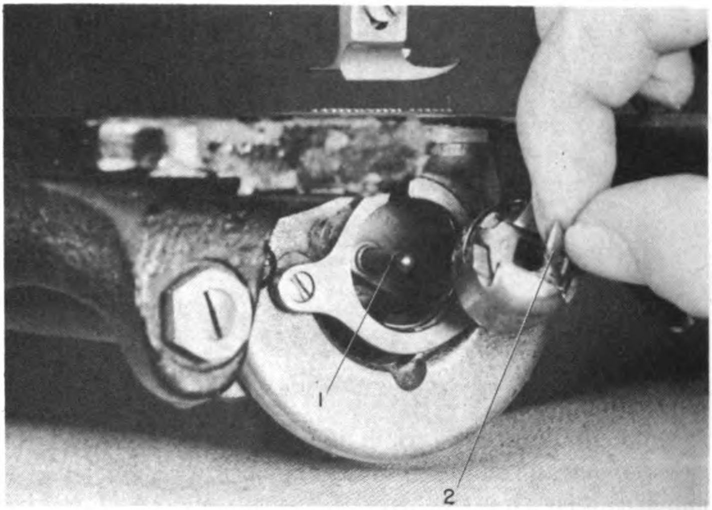


Figure 55. — Removing the bobbin.

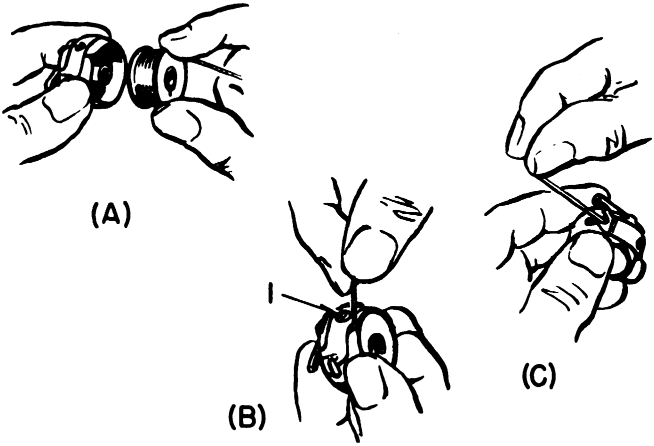


Figure 56. — Threading the bobbin case.

To THREAD THE BOBBIN CASE, hold the bobbin between the thumb and forefinger of the right hand, the thread drawing on top from the left toward the right, as shown in figure 56 (A). The left hand holds the bobbin case, also shown in (A), with the slot in the edge near the top. Place the bobbin in its case. Pull the thread into the slot in the edge of the bobbin case, as illustrated in (B), drawing the thread down under the tension spring and into the delivery eye at the end of the tension spring as shown in (C).

After threading, place the bobbin case on the winder stud (1), shown in figure 55, of the shuttle body with the position finger opposite the notch at the top of the shuttle race. Release the

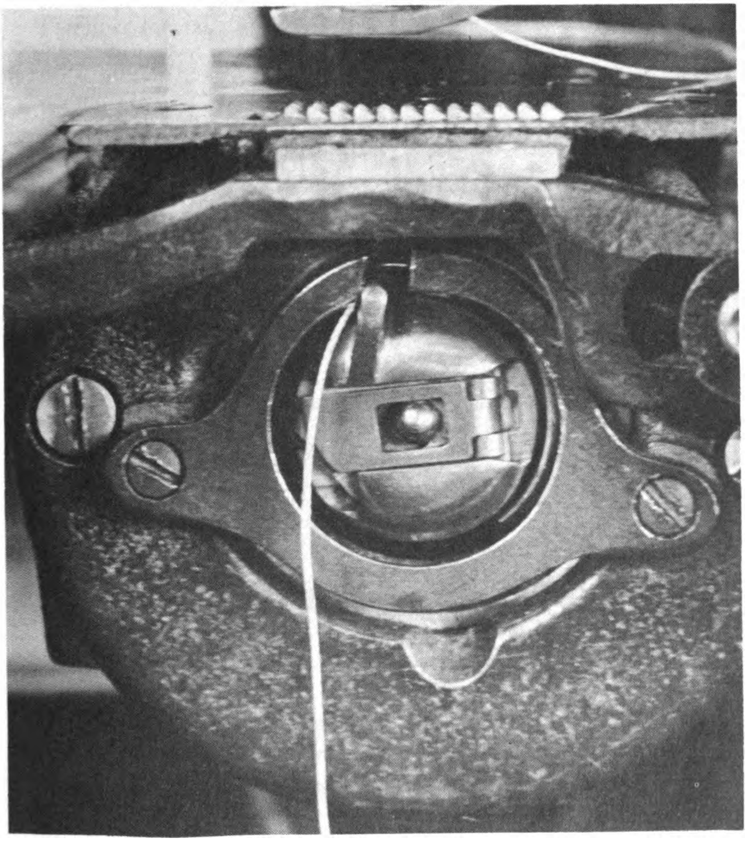


Figure 57. — Bobbin case threaded and replaced.

latch and press the bobbin case back until the latch catches the groove near the end of the stud, as depicted in figure 57. Allow about two inches of thread to hang free.

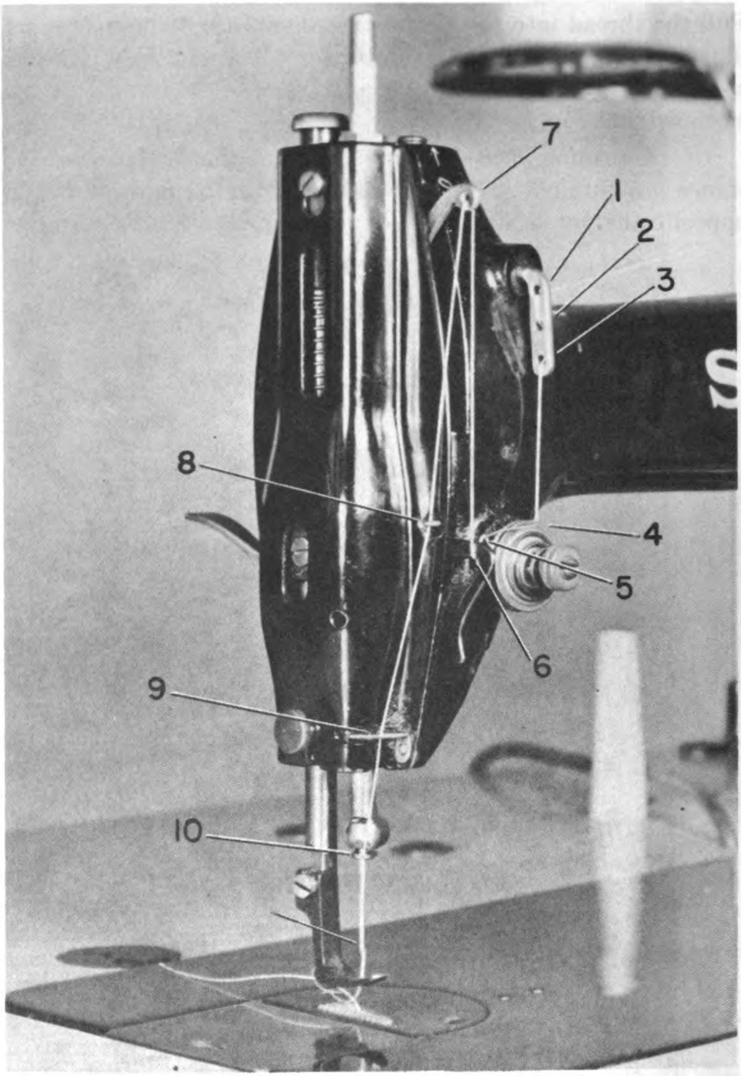


Figure 58.— Threading the needle.

In threading the needle, refer to figure 58 as you read the following instructions. Pass the thread attached to the unwinder from right to left through the top hole (1) in the thread-retainer, from left to right in the middle hole (2) in the thread-retainer, and from right to left through the bottom hole (3) in the thread-retainer, continuing down and under from right to left between the tension discs (4), into the thread take-up spring (5), under the tension thread-guard (6), upward and from right to left through the hole in the thread take-up lever (7), down through eyelet (8) and eyelet (9) and into eyelet (10), and from left to right through the eye of the needle (11). Draw about two inches of thread through the eye of the needle with which to commence sewing.

Tension on the needle should be regulated only when the presser foot is down. Then turn the small tension thumb nut,

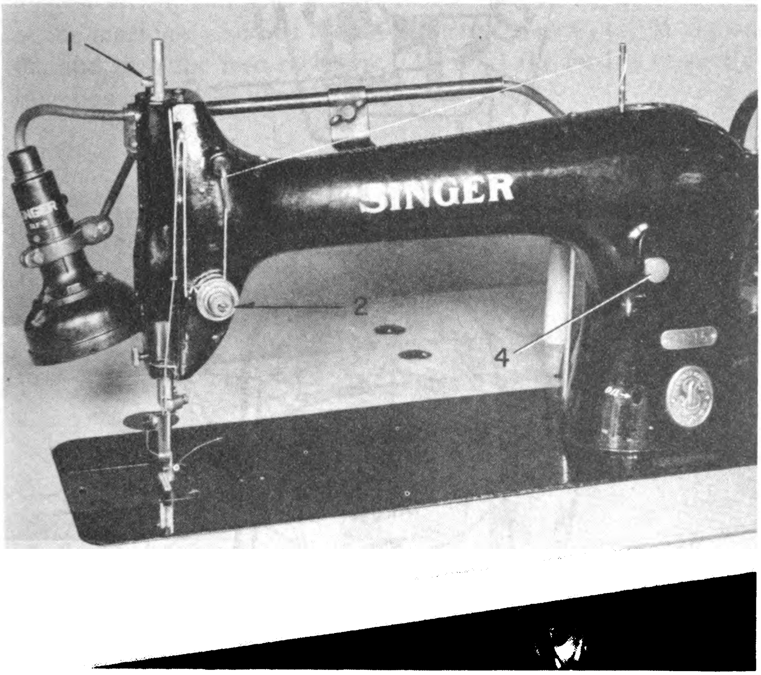


Figure 59. — Front view of the 31-15 machine, showing adjustments.

shown in figure 59, to the right to increase tension. To decrease tension, the nut is turned to the left.

Tension on the bobbin thread is regulated by the screw in the bobbin case tension spring, shown in figure 56 as (1). Tension is increased by turning the screw to the right, and decreased by left-turning.

To REGULATE PRESSURE ON THE MATERIAL, the thumb screw on the top of the machine, identified as (1) in figure 59, is turned to the right to increase pressure and to the left to lower pressure.

To TIME THE NEEDLE WITH THE SHUTTLE, see that the needle is pushed its entire length into the needle clamp. Turn the balance wheel toward you until the point of the shuttle reaches the center of the needle on the upward stroke of the needle-bar. When the shuttle is in this position, the needle-bar should have risen 1/10-inch, and the top of the eye of the needle should be 1/16-inch below the point of the shuttle, as shown in (D) of figure 60. If the eye of the needle is not the correct distance

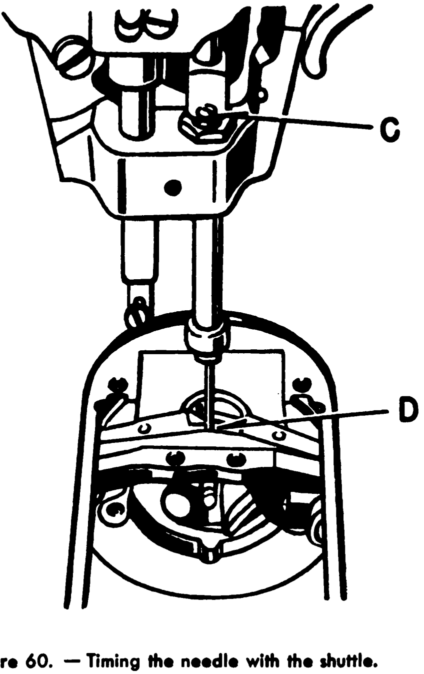


Figure 60. — Timing the needle with the shuttle.

below the point of the shuttle, loosen screw (C) in the needle-bar connecting stud and move the needle-bar up or down as required.

To RAISE OR LOWER THE FEED DOGS, the feed lifting rock shaft crank, (F) in figure 61 should be so set that it raises the feed bar to its highest point — slightly less than the full depth which the teeth project through the slots in the throat plate. To raise or lower the feed plate, loosen clamping screw (G), and move the feed lifting rock shaft crank (F), until the feed dog is set at the required height.

The FEEDING MECHANISM should be timed so that the feed dog completes its feeding movement (away from the operator) when the thread take-up lever, (7) in figure 58, is at its highest point. The feed should always complete its movement before the needle reaches the material on its downward stroke. When it is necessary to time the feeding mechanism, press the stitch-regulator, (4) of figure 59, down to its lowest point for the longest stitch, and turn up the round cover plate at the back of the machine. Loosen the feed eccentric screw, (H) in figure 62, and turn the feed eccentric, (J), until the feed is correctly timed as instructed above.

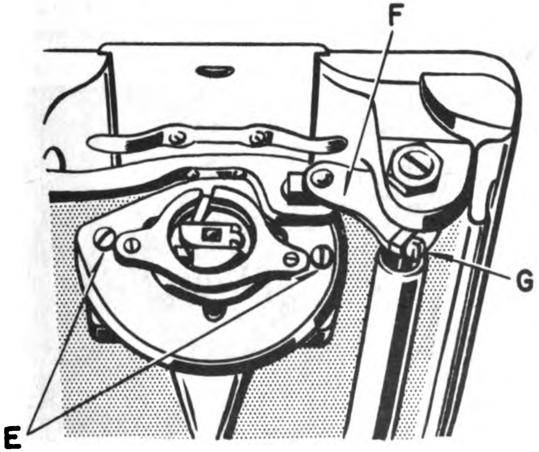


Figure 61. — Adjustment for raising and lowering the feed dog.

The THREAD-CONTROLLER SPRING, indicated as (M) in figure 63, should be set so that when the eye of the needle reaches the material on the downward stroke of the needle-bar, the spring

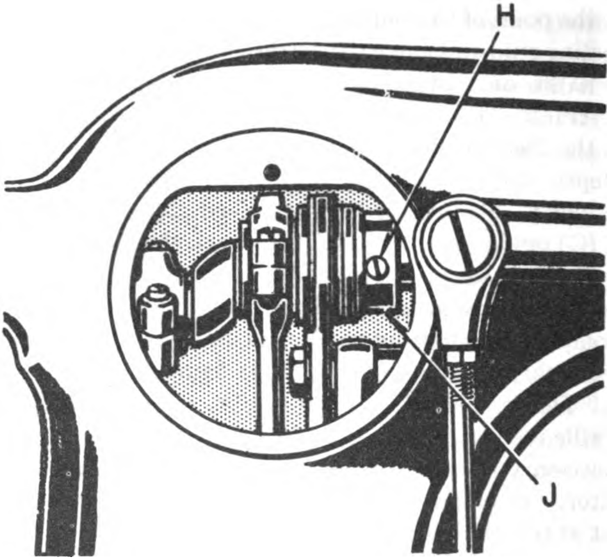


Figure 62. — Adjustment for timing feeding mechanism.

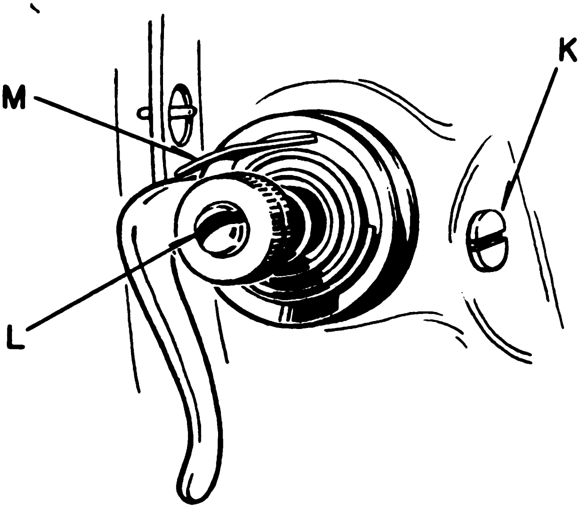


Figure 63. — Adjustment of the thread-controller spring.

will rest against the stop on the thread-controller spring regulator. If the spring is not correctly set, loosen set screw (K) in the arm of the machine and turn tension stud (L) to the right for greater movement of the spring or to the left for less movement. The tension on a thread-controller spring should be barely sufficient to take up the slack of the needle thread until the eye of the needle reaches the material in its descent.

To increase the tension of the thread-controller spring, (M) of figure 63, loosen the tension stud screw, (L), and force the controller spring from the recess in the regulator to the right between the regulator and the tension discs until the required tension is attained. Then securely tighten the tension screw stud and force the spring back into its position in the regulator recess. To decrease the tension, force the spring to the left between the regulator and the tension discs.

SEWING MACHINE — 143WSV8

SEWING MACHINE MODEL 143WSV8, illustrated in figure 64, has an aluminum alloy vibrating needle-bar frame and a rotary hook. It has ball bearings on the rear of the arm shaft and hook driving shaft. The needle has a maximum throw of 7/32-inch, vibrating both sides of a center line, and is usually referred to as a DOUBLE ZIGZAG MACHINE.

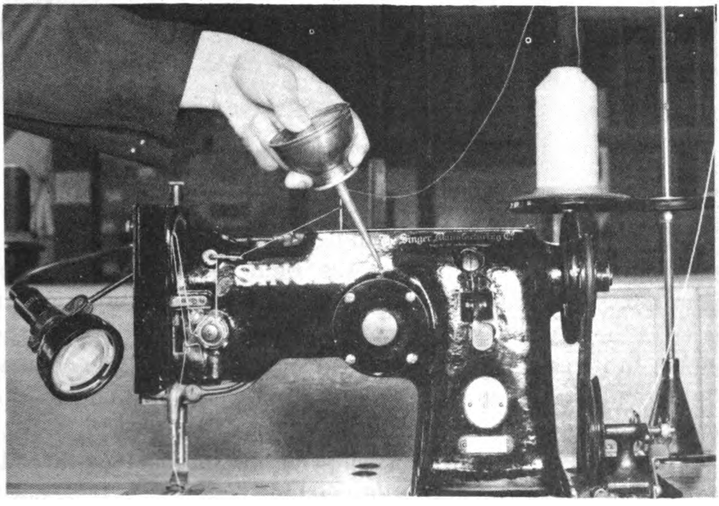


Figure 64. — Sewing machine — 143WSV8.

The 143WSV8 is used for anchoring shroud lines in the parachute canopy and for sewing shroud line ends at the harness links. The maximum speed recommended for this machine is 3500 stitches per minute. When in operation, the balance wheel should turn toward the operator.

To REMOVE THE BOBBIN CASE OF THIS MACHINE, lift the bobbin case latch, as shown in figure 65, and draw the case out and away from you. Turn the open end down, release the latch, and the bobbin will drop out.

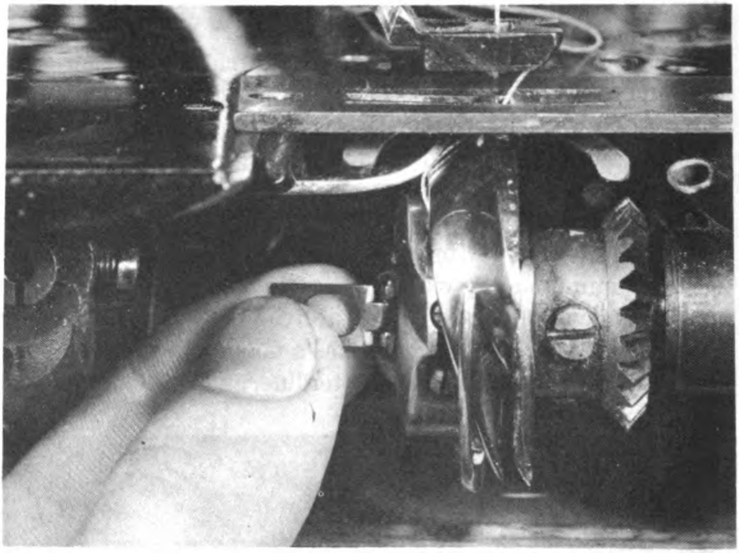


Figure 65. — Removing the bobbin case.

To THREAD THE BOBBIN CASE, hold the bobbin between thumb and forefinger of the right hand, the thread drawing on the bottom from the left toward the right as shown in (A) of figure 66. With the left hand, hold the bobbin case as shown in (A), the tension spring open at the front, and place the bobbin in its case. Pull the thread into the slot in the edge of the bobbin case as illustrated in (B), and into the end of the tension spring as shown in (C).

Figure 58 will guide you in following instructions for threading the needle on the 143WSV8 machine.

Turn the balance wheel until the thread take-up (10) is at its highest position. Pass the thread from the unwinder, from back to front; through the lower hole (1) in the pin atop the machine; from right to left through the upper hole in the pin (2); downward through hole (3) and upward through the middle hole (4); then again downward through the hole (5) of the thread straightener; down and to the left between the tension discs (6); and against the pressure of the controller springs into the fork at (7); to the right of the wire guard (8).

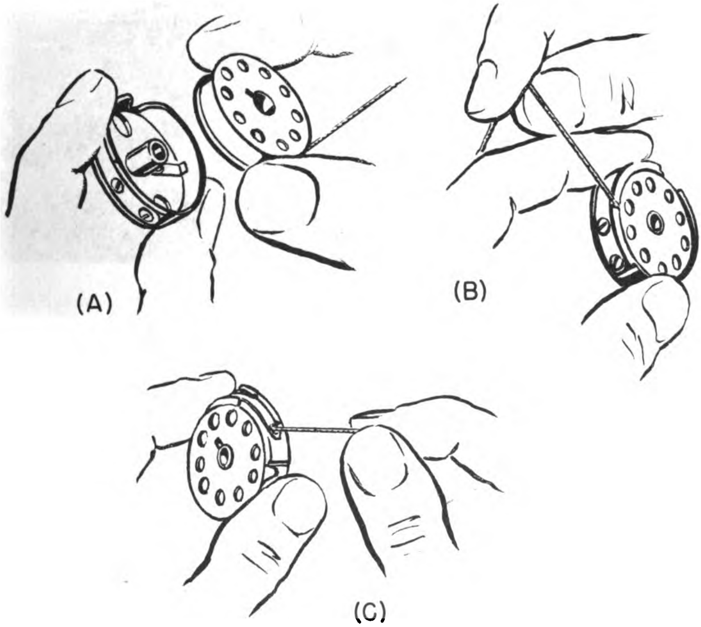


Figure 66. — Threading the bobbin case.

From the wire guard, pass the thread up through the thread-guide (9) from right to left through the thread take-up eyelet (10); down again through the guide (9) against the auxiliary thread take-up and back of the guide (11); down through the guide (13) at the lower end of the needle-bar, and from front to back through the eye of the needle (14), drawing about two inches of thread through the eye.

The pressure of the presser foot on the material should be

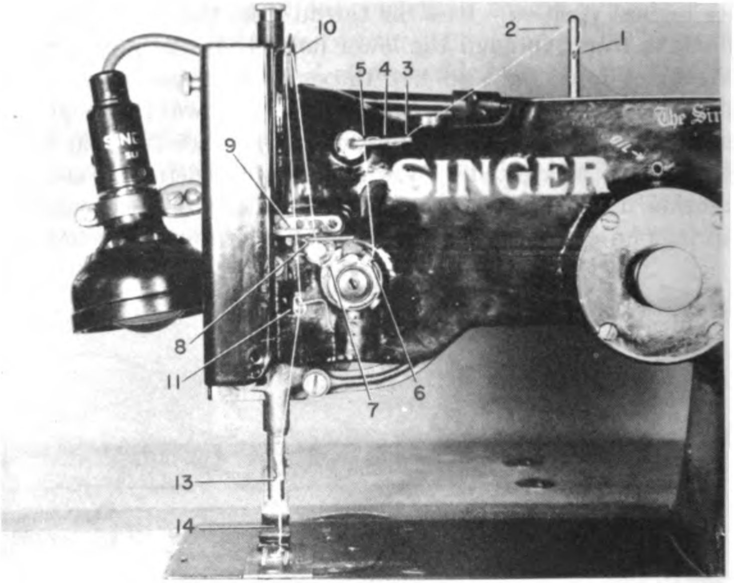


Figure 67. — Threading the needle.

sufficiently heavy that the material is fed properly at all speeds.

PRESSURE ON THE MATERIAL is regulated by the thumb screw, (F) of figure 68, at the top of the machine. Loosen the set screw, (G), at the back of the machine and turn the thumb screw downward for greater pressure or upward for decreased pressure.

TO REGULATE TENSIONS ON THE NEEDLE THREAD, lower the presser foot and turn the thumb nut (S), figure 69, at the front of the tension discs, to the right to increase tension or to the left to lower tension. TENSION ON THE BOBBIN THREAD is regulated by the screw, (A) of figure 66, in the tension spring on the outside of the bobbin case. This screw is turned to the right to increase tension and to the left for the opposite effect.

THE WIDTH OF BIGHT OR ZIGZAG STITCH is regulated by means of the needle vibrator regulating spindle head. The extreme width of a zigzag stitch is 7/32-inch.

The THREAD-CONTROLLER SPRING, marked as (Q) in figure 69, is designed to hold back the slack of the needle thread until the eye of the needle barely reaches the material in its descent.

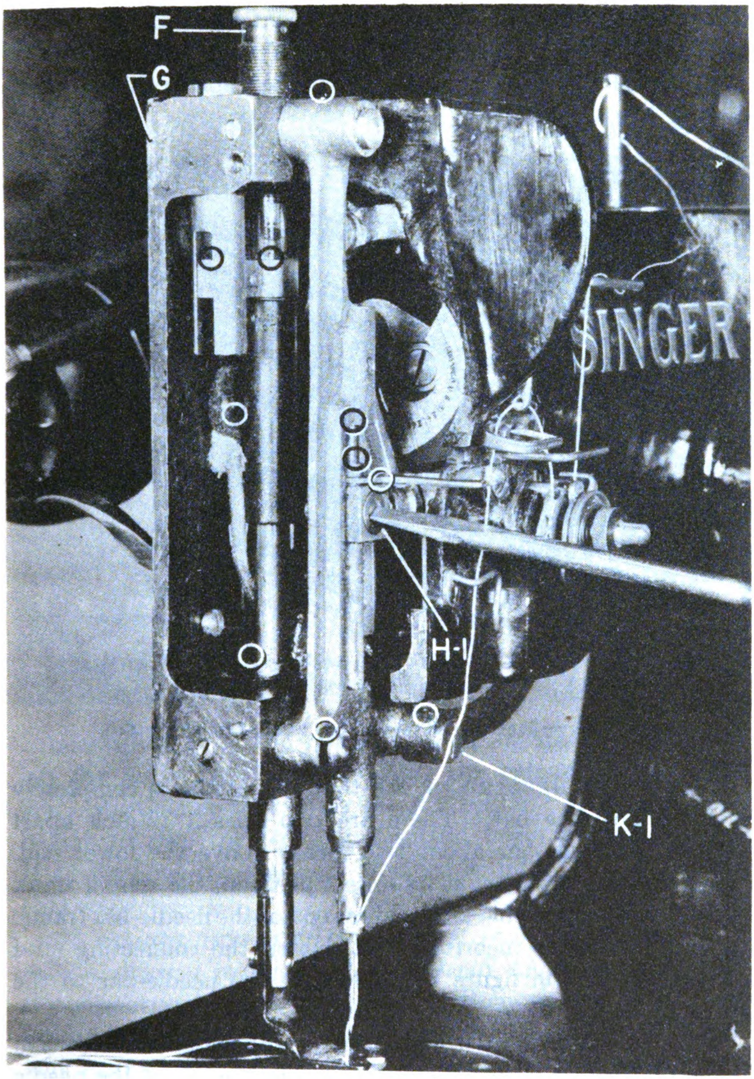


Figure 68. — Face plate removed to show adjustments and oiling points.

For greater controller action on the thread, loosen stop screw (U), and set the stop (R) lower. For less action, raise the setting of the stop. The position of the controller spring, as shown in figure 69 (Q), is the best average setting for stitching silk fabrics.

To strengthen the action of the controller spring on the thread, loosen the tension stud screw (V) and turn the tension stud (T) slightly to the left. To lighten spring action, turn the stud to the right.

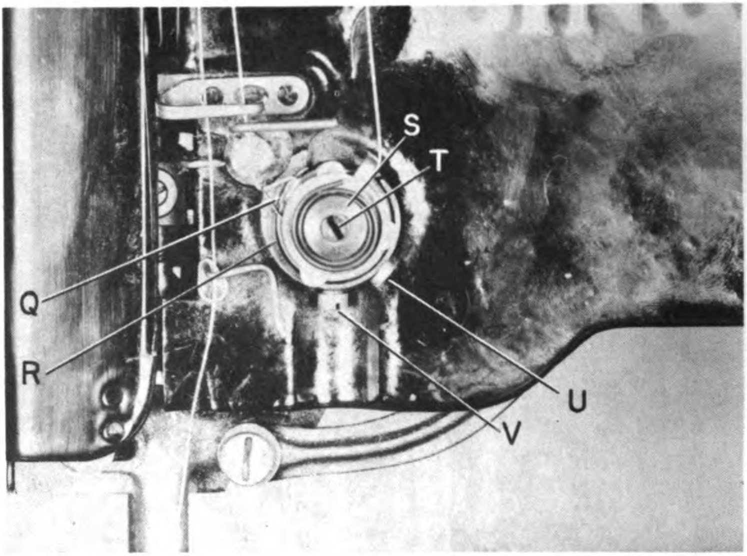


Figure 69. — Regulation of tensions and thread-controller action.

To SET THE NEEDLE-BAR, see that the needle is completely inserted into the bar. There are two lines 3/32-inch apart across the needle-bar about two inches above the lower end. When the needle-bar is at its lowest position, the UPPER MARK should be barely visible at the lower end of the needle-bar frame. In case the bar is incorrectly set, loosen the connecting stud set screw, (H1) in figure 70, and move the needle-bar to the correct position.

To set a needle-bar without a mark, set the bar so that when it rises 3/32-inch from its lowest position, the eye of the needle will be about 1/16-inch below the point of the hook as the hook enters the thread loop.

To set and time the needle-bar frame, first turn the needle vibrator spindle head, shown in (A) of figure 70, all the way to the right so that the needle will not vibrate when the machine is running. A straight needle should now center in the throat-plate needle-hole; but if it does not, loosen the set screw holding the eccentric stud (K1), turning the stud until the needle centers.

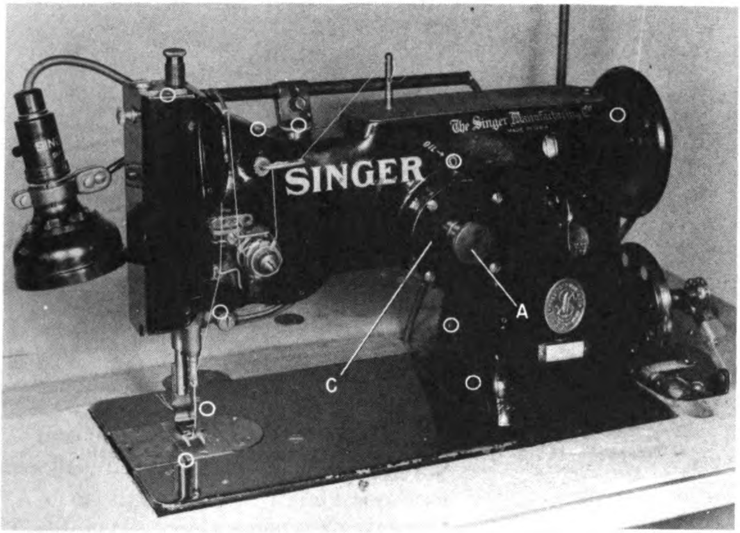


Figure 70. — Front view of the 143WSV8 machine, showing adjustments and oiling points.

Now turn the needle vibrator regulating spindle head to the left for the widest throw, turning the balance wheel toward you until the needle is at its lowest position. As the needle-bar begins to rise, the bar frame should begin moving sidewise. If such is not the reaction, advance or retard the pinion gear (M) as necessary.

To REMOVE THE NEEDLE VIBRATOR GEAR SHAFT, remove the needle vibrator regulating spindle head, (A) of figure 70, and the eccentric bracket cover, (C). Remove the locking and adjusting screws, (A1) and (B1) of figure 73, and also the screw and spring, (E1) of figure 73. Loosen the two set screws in the gear, (D1), and remove the needle vibrator gear shaft collar, shown as (L) in figure 72. The shaft may now be drawn free.

When replacing these parts, make certain that the large washer, (C1) of figure 73, is in place between the gear and arm, and be sure that the position screws are set firmly against the

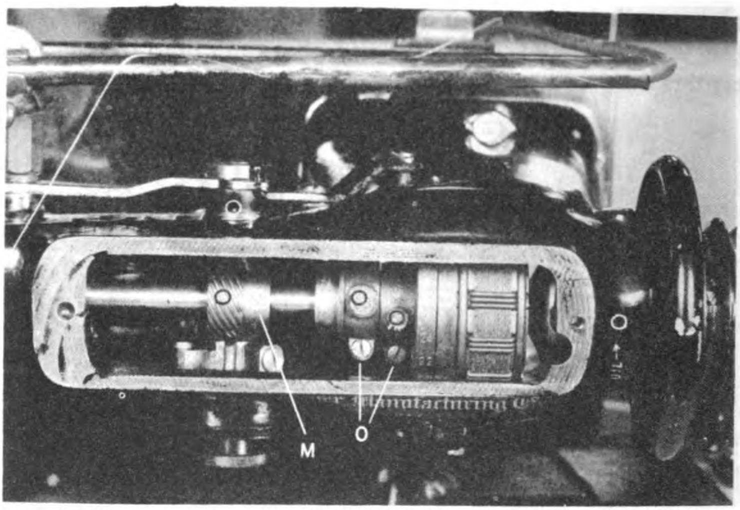


Figure 71. — Top view of 143WSV8 machine, showing adjustments and oiling points.

flat spots on the shaft. Check to see that the set screws are at the right of the position screws when the shaft has been returned to its place.

TO SET THE NEEDLE VIBRATOR REGULATING SPINDLE HEAD SO THAT A WIDER THROW THAN THAT DESIRED CAN BE MADE, turn the spindle head, shown as (A) in figure 70, to make the widest possible bight. Remove locking screw, (A1) in figure 73, and turn the screw (B1) until the stitch is of the width desired. Turn the screw (A1) down tightly on screw (B1) as a check.

TO TIME THE SEWING HOOK, remove the throat plate and turn the balance wheel toward you until the lower timing mark on the needle-bar is just visible at the end of the needle-bar frame, or until the needle-bar has risen 3/32-inch. If the needle and hook are in correct time, the point of the hook will be opposite the center of the needle.

To time the hook, loosen the set-screws in the lower belt-pulley, (J) of figure 74, and turn the hook as required. Before tightening the set screws, make certain that no end play is present in the shaft.

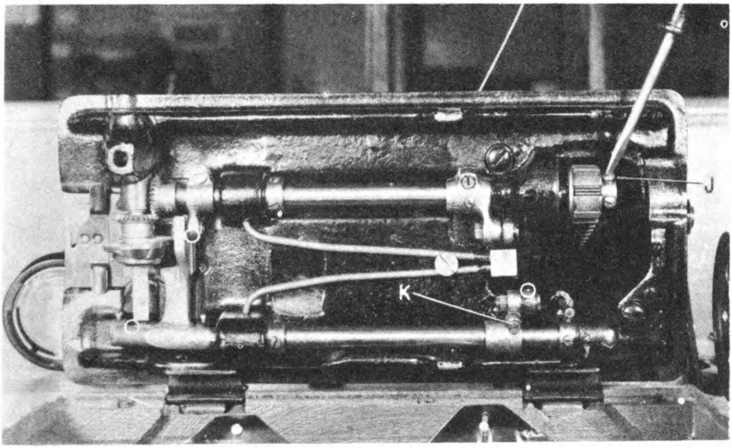


Figure 74. — Adjustments beneath 143WSV8 machine.

The point of the hook should come as close as possible to the needle without actual contact. Loosen the four screws, (X) and (AA) in figure 75, and slide the hook to the correct position. Tighten the two screws, (X), then reset the gear on the hook shaft and tighten screws (AA).

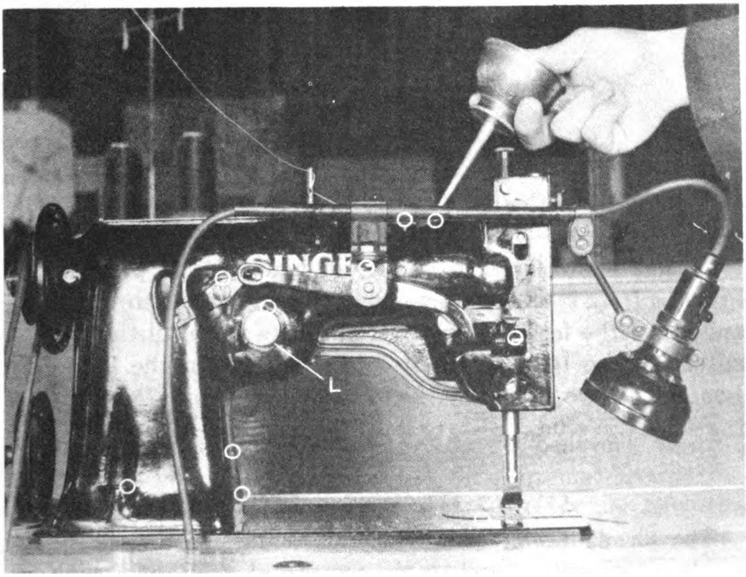


Figure 72. — Rear view of 143WSV8 machine, showing adjustment and oiling points.

To REMOVE THE HOOK, remove the bobbin case, indicated as (Y) in figure 75. Loosen the hook spindle screw (W) a few turns and tap it lightly to loosen the hook. Then remove the screw (W) and withdraw the hook from its socket.

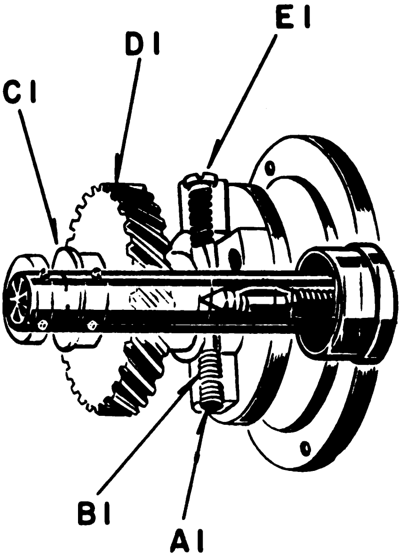


Figure 73. — View showing needle vibrator regulating spindle head in front of machine.

To take up loose motion of the feed driving and lifting connections, adjust their pinch screws, shown as (0) in figure 71.

Loosen screws marked as (K) in figure 74, to prevent the feed dog from striking either end of the slots in the throat plate, and move the feed dog forward or backward until the longest stitch can be taken without interference from the feed dog. Loosen the two screws marked as (CC) in figure 75, and turn the eccentric stud, (BB), to level the feed dog.

SEWING MACHINE — 144W202

The CLASS *144* MACHINE, shown in figure 76, is a single-needle, lock-stitch unit with compound feed and high-lift

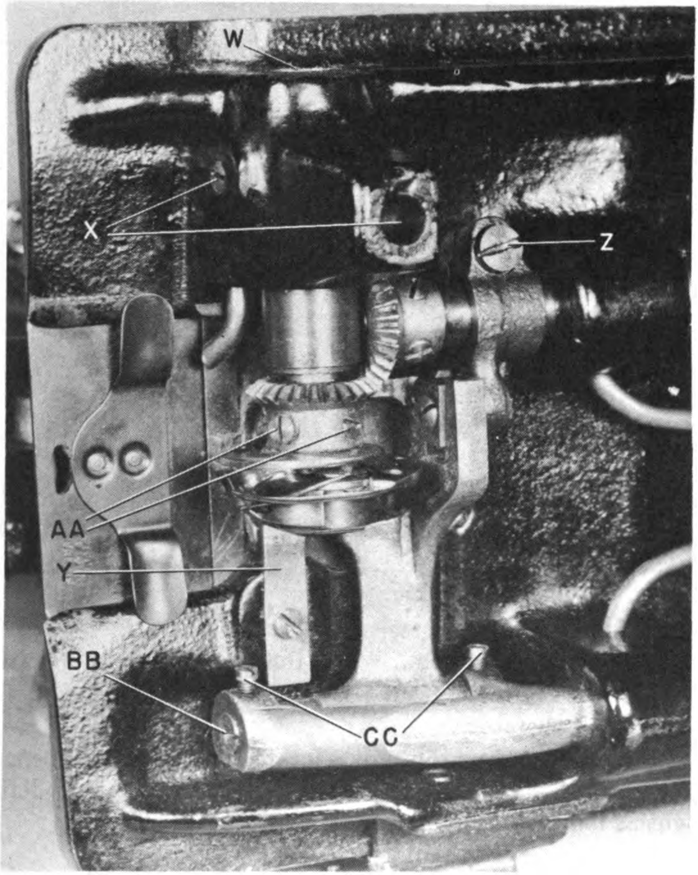


Figure 75. — Adjustments on underside of 143WSV8 machine.

alternating pressers. It is used for attaching containers to parachute harnesses and for sewing tarpulins. This machine is capable of sewing medium- and heavy-weight fabrics.

The 20-inch working space at the right of the needle makes this machine extremely satisfactory for all container repairs, as it makes possible the pivoting of the container around the needle. Also because of its high-lift alternate pressers, the Class 144 machine is ideal for closing the end of the container after inserting the frame.

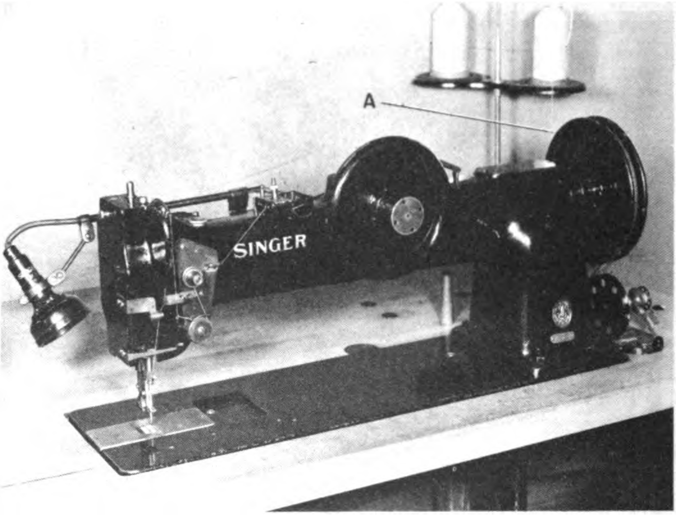


Figure 76. — Sewing machine 144W202.

The maximum speed recommended for Machine 144W202 is 1500 stitches per minute. When the machine is in operation, the balance wheel, indicated as (A) in figure 76, should turn toward the operator.

The bobbin case on this unit is located under the slide beneath and to the right of the needle, the thread drawing from left to right as illustrated in figure 77.

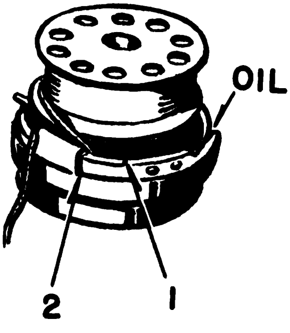


Figure 77. — Direction of thread on bobbin.

Figure 78 illustrates the bobbin case fully threaded and replaced in the machine.

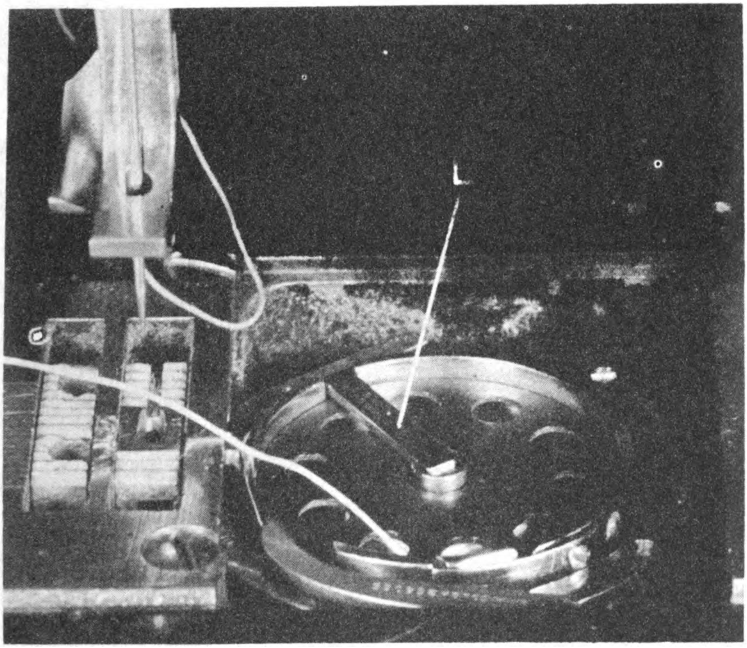


Figure 78. — Bobbin case threaded.

Instructions for threading the needle of the 144 Model sewing machine are shown in figures 79 and 80.

Pass the thread from the unwinder through hole (1) in the thread oiler (figure 80), and under the wire guide (2), which may be raised by prying the end (X) out of its position-hole with a screwdriver and turning it to the right. Pass the thread under the oil pad (3) and out through one of the notches (4) in the thread oiler. For local parachute repairs, the thread oiler may be bypassed.

Now consult figure 79. From the notch (4) in the thread oiler, pull the thread downward to the thread guide. Pass the thread up through the eyelet (5), down through eyelet (6), over to and between tension disc (7), around thread-controller (8), into tension guide (9), into thread-controller spring (10), through guide (11) and hole (12) in the take-up lever, through

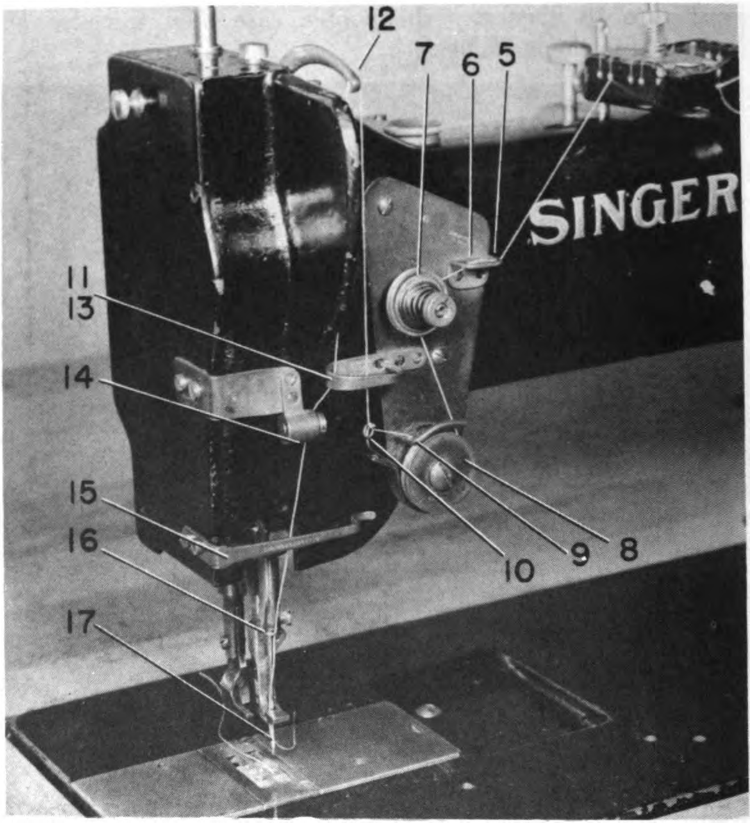


Figure 79. — Threading the needle.

guide (13), into thread-guide (14), back of lower guide (15), into the self-threading needle-bar guide (16), and from left to right through the needle-eye (17).

The PRESSER FEET, shown at the lower left of figure 79, are raised by exerting pressure on the foot treadle, and may be locked in the raised position by moving the lever designated as (A) in figure 81 completely to the left. A slight pressure of the treadle will automatically release the locking devices.

In figure 81, circles without letters indicated points where oil should be applied. This does not, however, furnish a complete description of the proper oiling points and procedure for this machine.

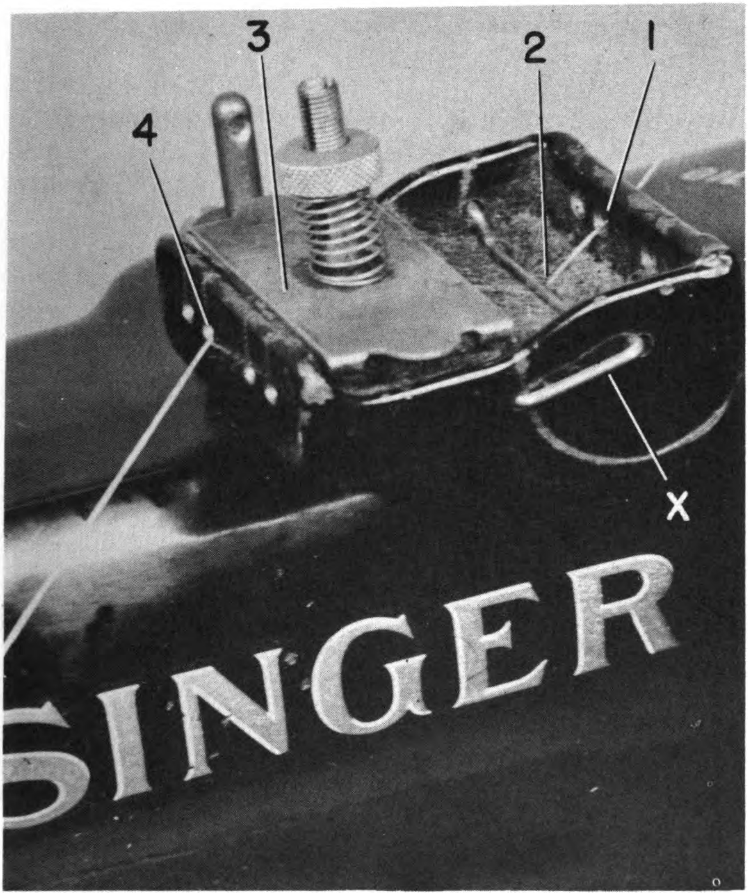


Figure 80. — Thread oiler.

To increase pressure on material being worked, turn the thumb screw, (D) of figure 82, so that it moves downward. The opposite adjustment decreases pressure.

The thread controller spring should be set so that it reaches its lowest point when the eye of the descending needle is nearly level with the material on the machine. For greater action on the thread by the controller, loosen the top screw shown as (O) in figure 83, and lower the stop setting. For less action, set the stop to a higher position.

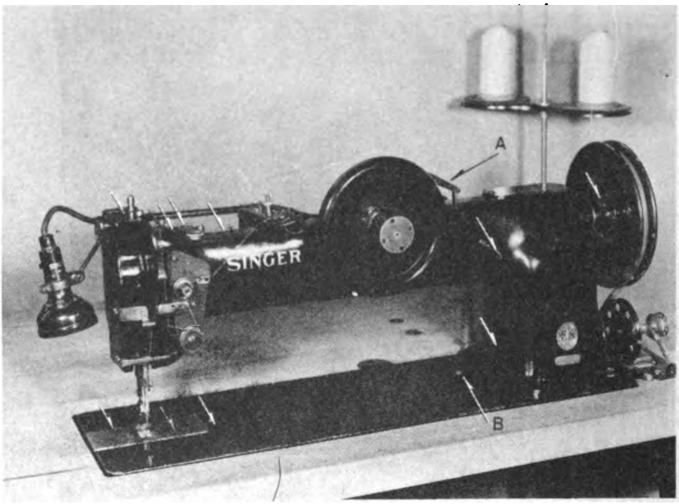


Figure 81. — Front view of machine showing locker lever for presser feet.

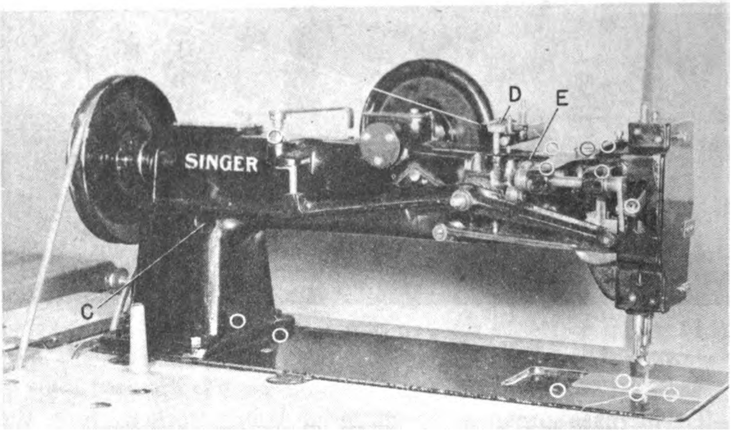


Figure 82. — Rear view, showing adjustments.

To strengthen the action of the controller spring on the thread, loosen the spring stud screw, (P) of figure 83, at the rear of the stop screw, and turn the spring stud slightly inward and to the left. To lighten the action, turn to the right.

TO SET A NEEDLE-BAR CONTAINING NO MARKER, turn the feed-regulating spindle, shown as (A) in figure 84, so that there is no feed movement of the needle-bar frame. Then set the needle-bar so that when it raises 1/8-inch above its lowest position, the point of the sewing hook will be approximately 1/16-inch above the eye.

After turning the feed-regulating spindle head so that no feed movement of the needle-bar exists, THE DISTANCE BETWEEN THE VIBRATING PRESSER BAR AND THE LIFTING PRESSER BAR should be 5/8-inch, as shown in figure 85. If the distance is less than 5/8-inch, insert a screwdriver in the hole at (C), figure 82, and loosen the clamp screw holding the needle-bar frame rock shaft. While this screw is loose, the needle-bar frame may be moved forward or backward until the required distance is obtained.

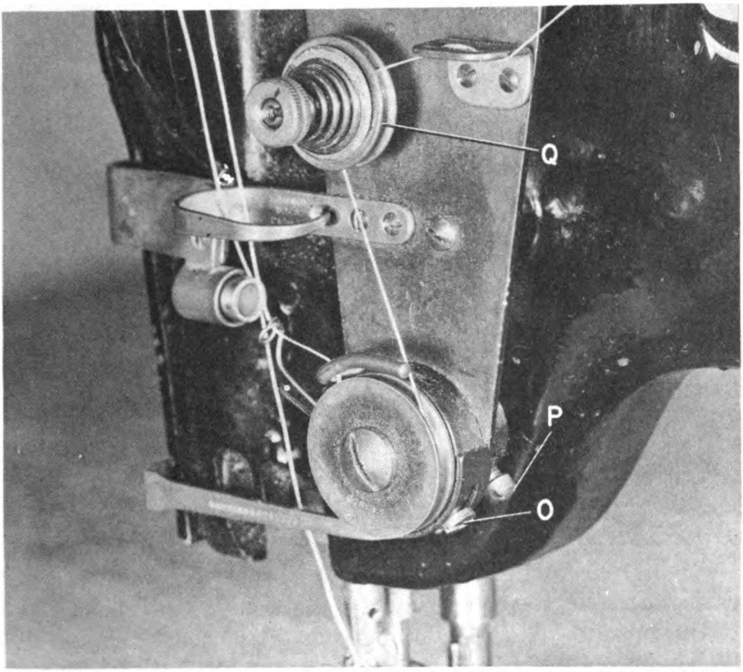


Figure 83. — Adjustment of the thread controller.

When making this adjustment, be certain that the feed-regulating spindle head is set so that no feed movement of the needle-bar is present.

The height of the lift of the pressers is adjusted by moving link (F), figure 85, to any of the four holes in the rock shaft

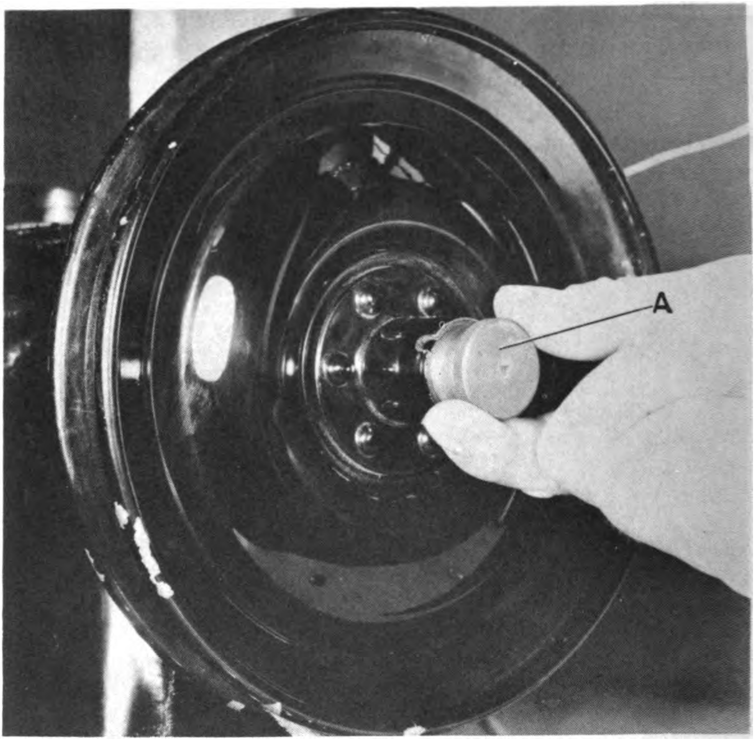


Figure 84. — Feed-regulating spindle.

crank at the left. The maximum lift is secured with the link (*F*) in the bottom hole. The amount of lift of the vibrating and lifting presser feed should be barely enough to clear the material being sewn. As a rule, the lift of both vibrating and lifting pressers should be the same, although some grades of work require varying amounts of lift.

To change the relative lift of presser feet, loosen screw (E) of figure 82, and move the vibrating presser bar upward or downward as required.

IN TIMING THE SEWING HOOK, make certain that the feed-regulating spindle, (A) of figure 84, is set to eliminate feeding motion. Remove the throat plate under the needle and turn the balance wheel toward you until, on the upward stroke of the needle-bar, the lower mark on the bar is just visible at the end of the needle-bar rock frame. If the needle-bar and sewing

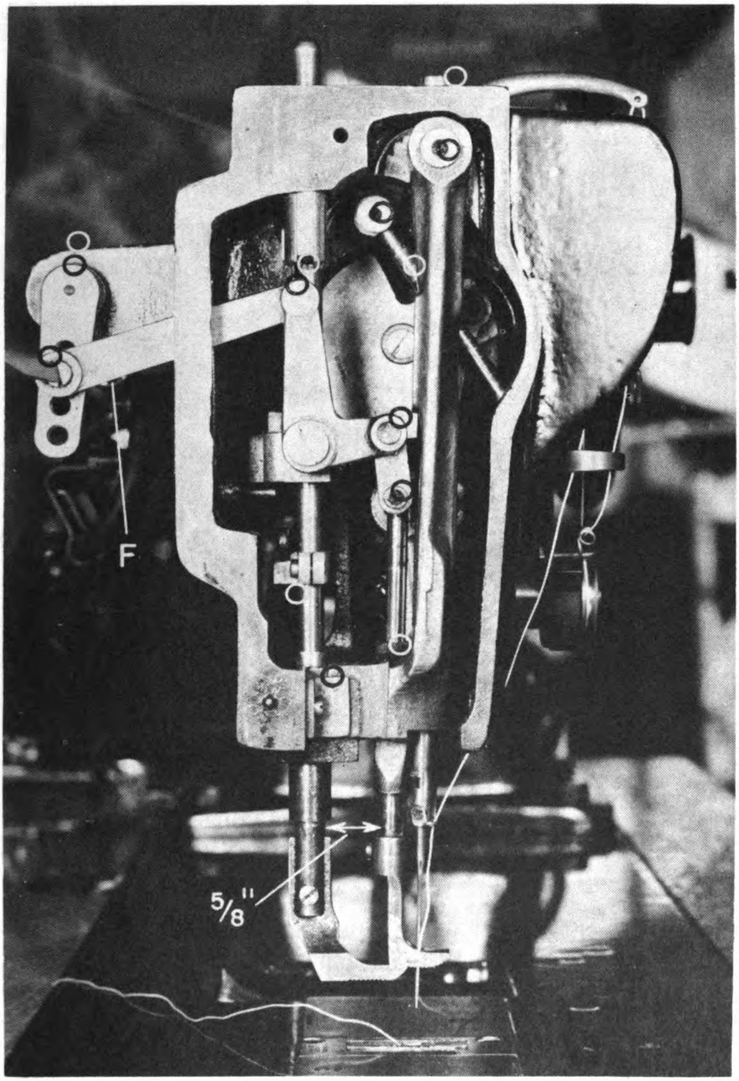


Figure 85. — End view of machine showing adjustments.

hook are correctly timed, the point of the hook will be at the center of the needle and about 1/16-inch above the eye. If the sewing hook is NOT correctly timed, turn the balance wheel toward you until the needle-bar has descended to its lowest

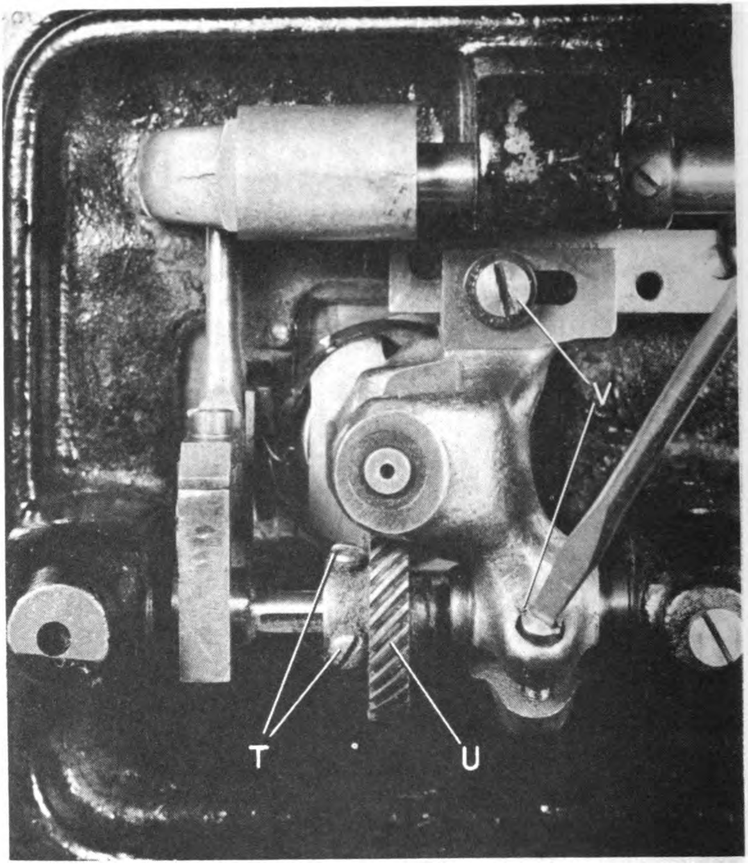


Figure 86. — Underside view of one end of the base.

point and has risen until the lower mark across the needle-bar is again barely visible at the end of the needle-bar rock frame. Then, on the underside of the machine, loosen the two screws, (T) of figure 86, in the hub of the hook drive-gear, (U). Tap this gear to the right or left on the hook driving-shaft until the point of the hook is at the center of the needle.

To prevent the point of the sewing hook from dividing the strands of thread, the hook should run as close to the needle (within the scarf) as possible. To adjust for this condition, turn the balance wheel toward you until the point of the sewing hook is at the center of the needle. Loosen screws (V), figure 86, and move the hook saddle to right or left as desired.

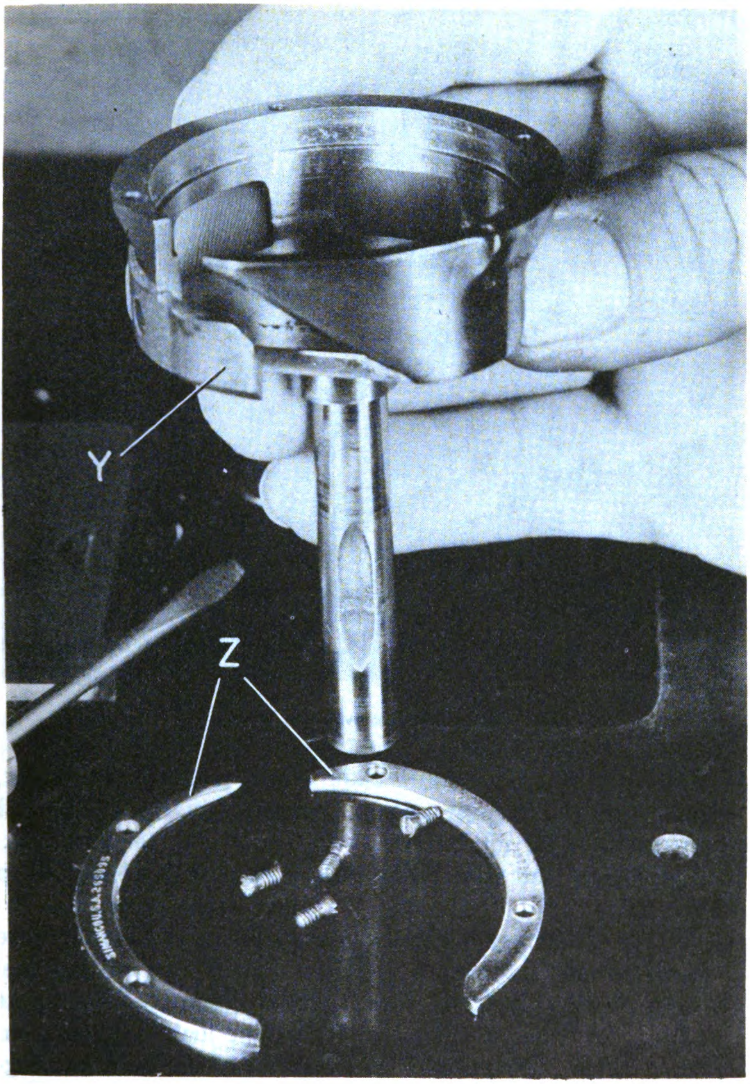


Figure 87. — Sewing hook removed from machine to show hook washer.

The hook guard washer, (Y) of figure 87, which is attached to the side of the sewing hook, should be in such position as to prevent the needle from striking the hook should the needle be deflected toward it at any time.

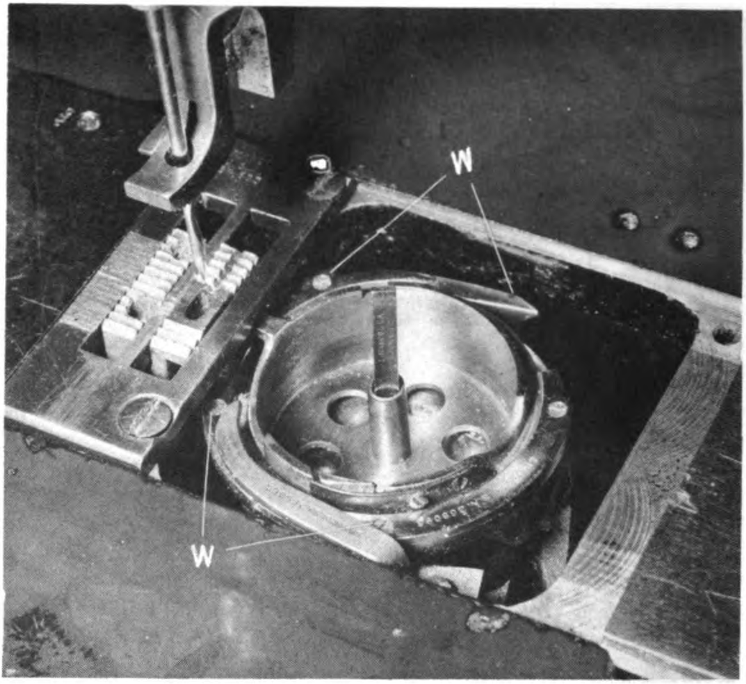


Figure 88. — Removing the bobbin.

To REMOVE THE BOBBIN CASE FROM THE SEWING HOOK, remove the bobbin case opener, indicated in figure 88, and remove the four gib screws, (W), from the sewing hook. Lift off the gib and remove the bobbin case, marked as (X) in figure 89.

The hook driving shaft and the shaft of the sewing hook are splined in order to prevent the hook from getting out of time. A safety clutch is located in the lower belt pulley. In the event of thread jamming, the clutch releases the locking lever from the notch, (D1) of figure 90, in the collar of the hook driving-shaft. Damage to the machine is prevented in this manner.

To re-engage the clutch, draw back the bed slide and remove the portion of thread jammed in the hook. Press down the lock stud, (B) of figure 81, which will engage the hook driving shaft-lock ratchet, and will prevent the hook driving-shaft from turning backward. Turn the balance wheel from you until the locking lever, (B1), snaps into the notch, (D1), in the shaft collar, as illustrated (figure 90).

The following procedure describes ADJUSTMENT OF THE HAND WHEEL SHAFT ON LONG ARM (*Class 144*) MACHINES. The hand wheel bushing, (F1) of figure 91, is eccentric and may be rotated to bring the hand wheel gear, (G1), into proper engagement with the gear on the arm.

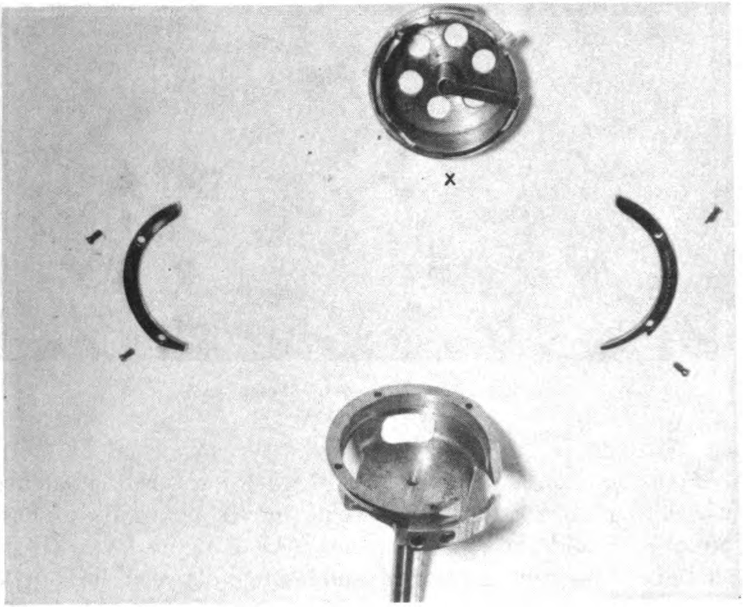


Figure 89. — Removing the bobbin case.

First remove the lock screw and loosen the bushing set screw beneath it. The bushing (F1) may then be tapped until only a slight trace of backlash remains between the gears.

SEWING MACHINE — 97-10

The CLASS 97 MACHINE, shown in figure 92, is a single-needle lock-stitch unit containing a cylinder bed and foot-lifter. This machine may be equipped with an electric-heating device which, if installed, should have a rheostat for heat control.

The Class 97 machine is designed for stitching parachute harnesses and heavy leather work. The maximum speed recommended for this unit is 400 stitches per minute.

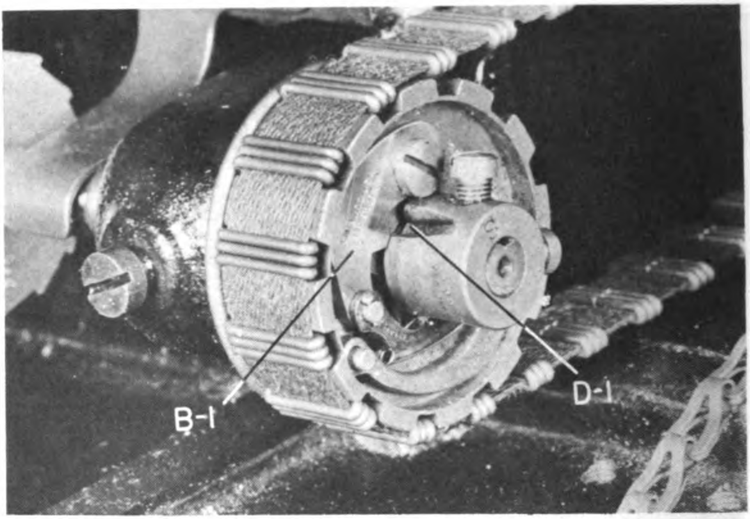


Figure 90. — Safety clutch (disengaged).

To remove the bobbin on the 97 machine, turn the balance wheel toward you until the needle moves up to its highest position. Hold the shuttle-opener, (A) of figure 93, with its curved end pointing downward, and insert it between the shuttle cylinder and the shuttle latchspring as explained in figure 93. Raise the end of the shuttle-opener, (A), and the shuttle bobbin-case will swing outward to permit removal of the bobbin.

To wind the bobbin, follow the instructions below, with the aid of figure 94. Place the bobbin winder on table or bench, securing it with several screws. Place the bobbin on the bobbin winder spindle and push it tightly against the shoulder, causing the small pin in the spindle to enter the slot in the bobbin. Remove the two thumb screws, (C) and (D), which hold the stripping device into the wax pot (E), and lift out the stripping device. Pass the thread from the unwinder down through hole (1), then through hole (2) at the far end of the thread post, through hole (3), and upward through hole (4), using the thread hook, (G), which is furnished with the bobbin winder. Place the stripping device back in position in the wax pot. Pass the thread over the roller, (5), and through the hole in the left side of the bobbin from the inside.

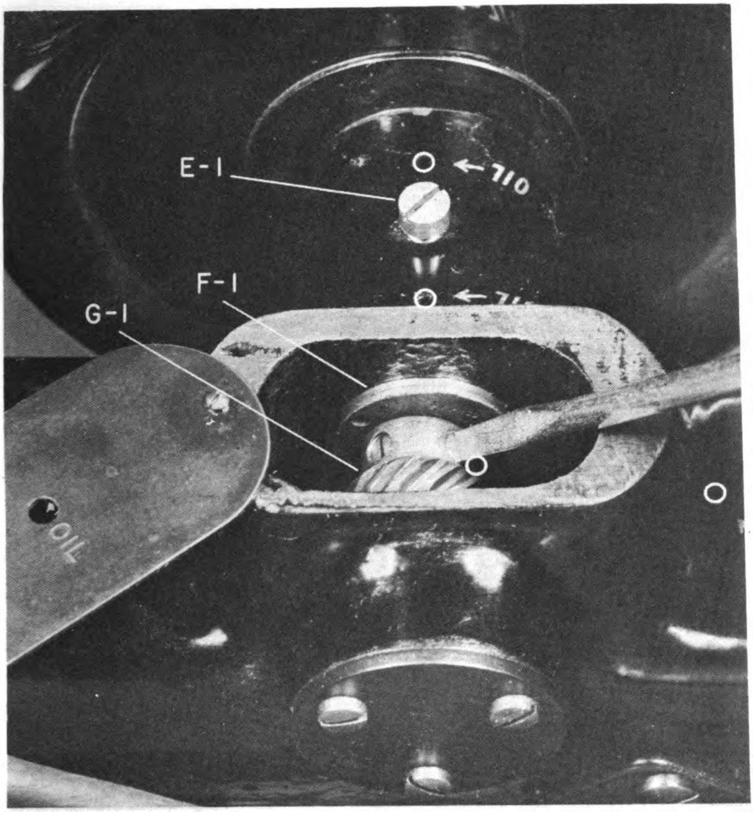


Figure 91. — Hand-wheel of long-arm machine.

If the thread is not to be waxed, it should be led directly from the unwinder through eyelet (6) and thence between tension discs and, from the inside, through the hole in the left side of the bobbin.

Compartment (E) in the wax pot contains wax, while compartment (F) is for water. The wax compartment should hold sufficient wax to fully cover the eyelets in thread posts (2) and (3), and the water compartment should be about three-fourths filled.

Allow the water to boil until the wax becomes sufficiently heated to flow freely, then turn the bobbin winder hand-wheel. The end of the thread must be held until a few coils are wound, then should be severed.

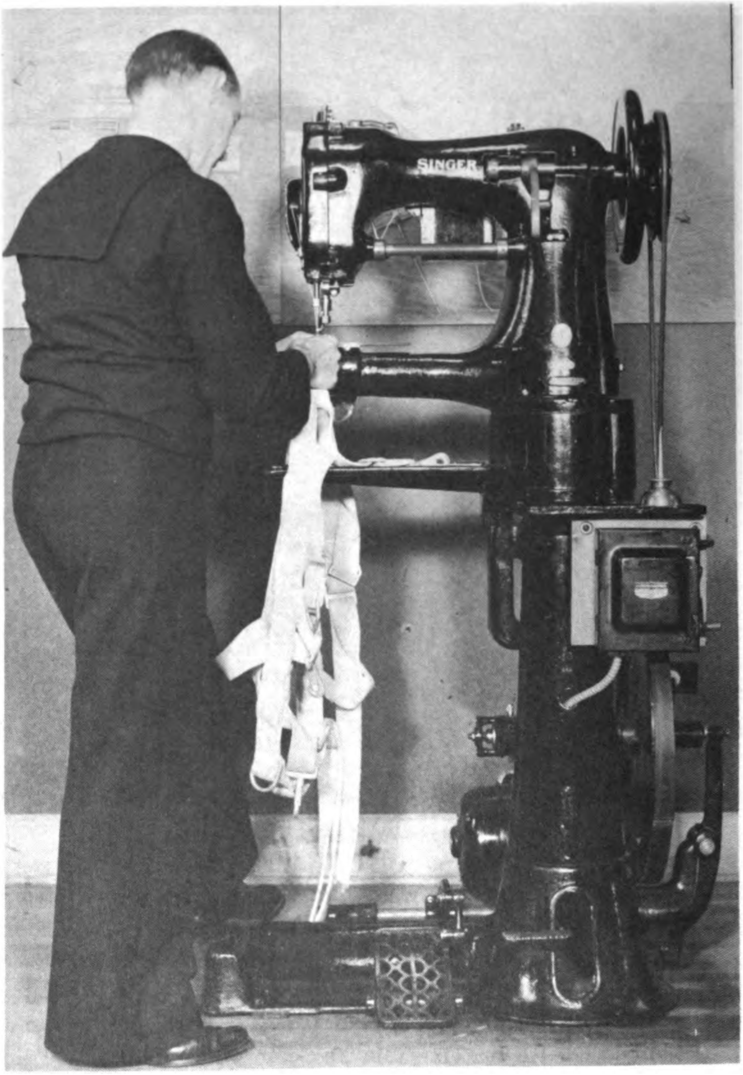


Figure 92. — Sewing machine — 97-10.

It is necessary that water be kept in compartment (F) at all times. Otherwise, the wax will burn and become unfit for use.

Parachute harnesses are no longer sewn with waxed thread due to the weakening properties of the hot wax.

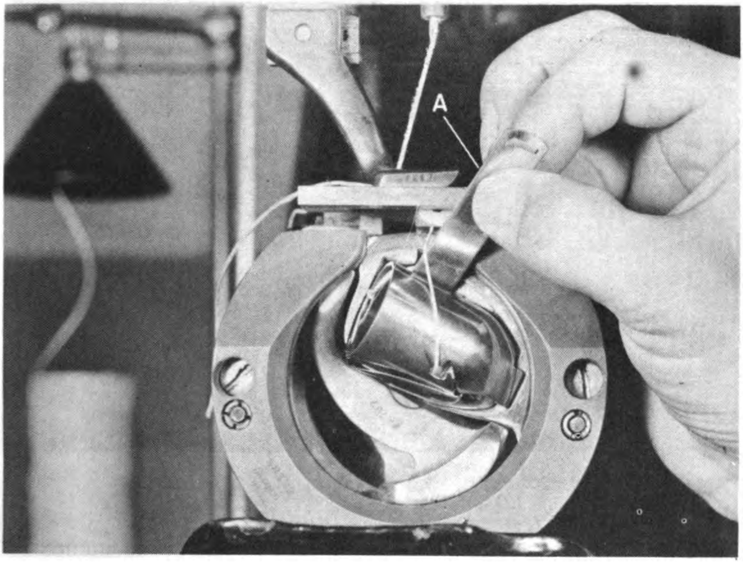


Figure 93. — Shuttle opener.

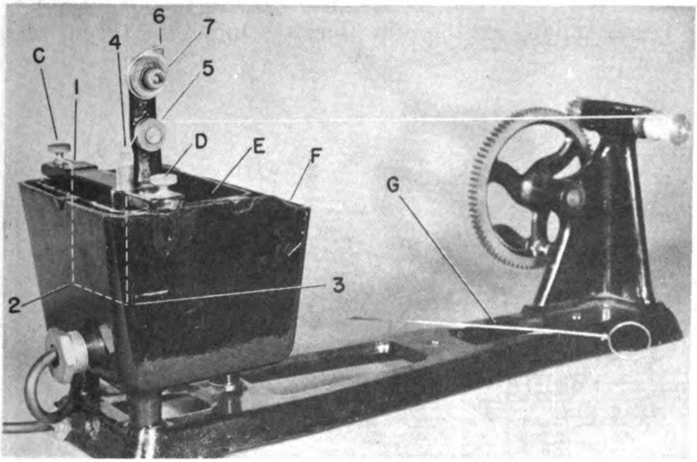


Figure 94. — Winding the bobbin.

TO REPLACE THE BOBBIN AND THREAD THE SHUTTLE, hold the bobbin between the thumb and forefinger of the left hand, with the thread drawing off the underside toward the right. Draw the thread into the slot in the cylinder, placing the bobbin in the cylinder as far as it will go. Draw the thread into the

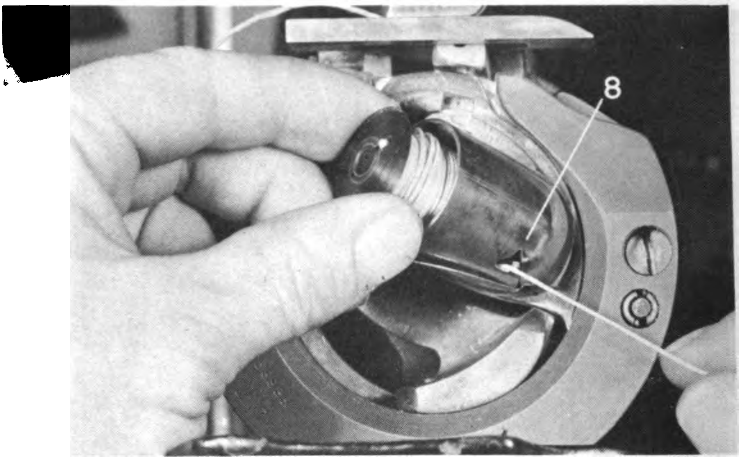


Figure 95. — Replacing the bobbin, Class 97 machine.

delivery eye ((8) in figure 95) allowing about three inches of thread to hang free of the shuttle.

One of the two needle guides in the 97 machine is fastened to the needle-guide bar, the other located under the throat plate.

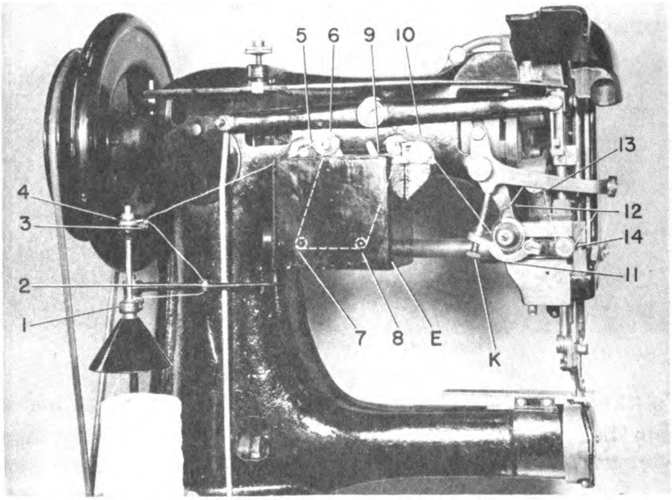


Figure 96. — Threading the needle (rear view).

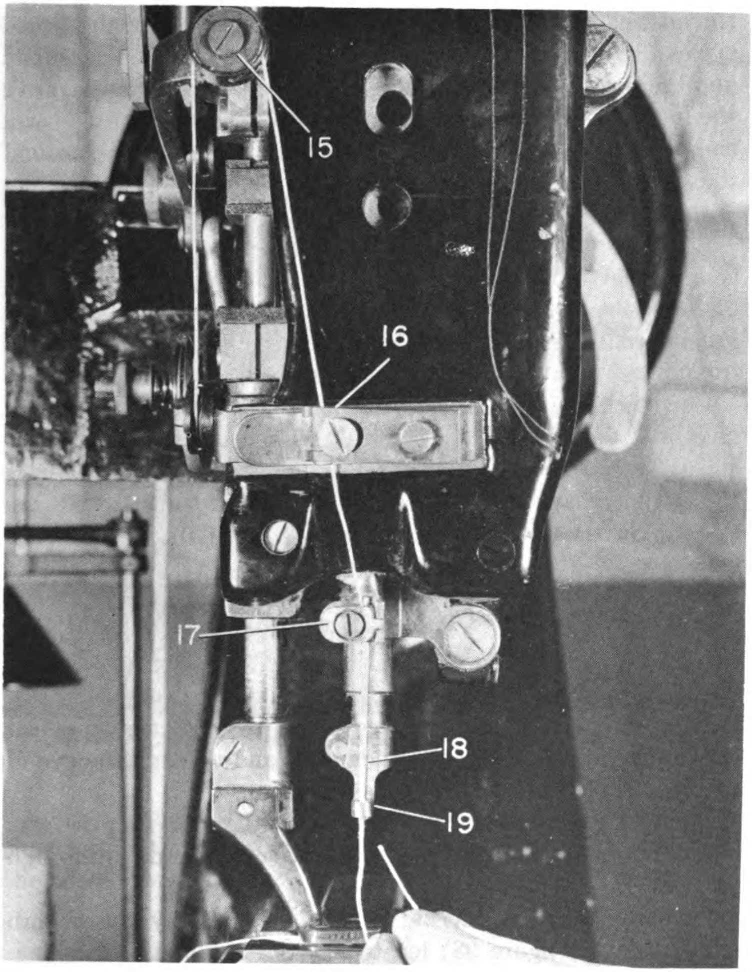


Figure 97. — Threading the needle.

The guides are marked with numbers corresponding to needle-size numbers. Remove the screw holding the lower needle-guide, using the combination screwdriver and wrench furnished with the machine, and lift out the guide.

Pass the thread from the thread unwinder upward and through hole (1) in the cone above the spool pin, and upward through the hole in thread guard (2). Form a loop with the thread and pass the loop from right to left through thread eyelet (3) with the right hand, holding the end of the thread and the thread leading from the spool with the left hand. Give the loop one complete turn toward you so that the thread will be twisted between points (2) and (5), and pass the loop around the thread-straightener wheel (4).

Remove the two screws holding the stripping device into the wax pot (E), and lift out the stripping device. Pass the thread from eyelet (3) over from left to right through eyelet (5), between the tension discs, (6), down under from left to right around roller (7) at the bottom of the stripping device, and from left to right around the bottom of the right roller (8).

Pull back the lever at the top of the stripping device and hook the thread into the slot in the stripper, (9). Pass the thread over from left to right through roller (10), and place the stripper back in the wax pot. Pass the thread, with the take-up in its lowest position, from roller (10), down under from left to right around tension wheel (11), passing the thread completely around tension controller (12), and over from left to right through collar (13) on the take-up arm. Next, pass the thread down under from left to right through roller (14), up and from back to front through take-up roller (15), down back of spring (16) on the face plate, through thread-eyelet (17), into the hole in needle guide (18), and through the eye of the needle, (19), toward the balance wheel.

If the thread is not to be waxed, omit the rollers on the wax pot and pass the thread directly from the tension discs through roller (10).

PRESSURE ON THE MATERIAL IS REGULATED by the thumb screw (N) (see figure 98) located at the top of the machine. To increase the pressure, the thumb screw is turned to the right, and in the opposite direction to decrease pressure.

Presser-foot pressure should be sufficient to hold the work firmly down so that the material will not rise when the needle is being withdrawn. Otherwise, skipping of stitches will result.

RAISE THE PRESSER FOOT ONLY WHEN THE NEEDLE IS AT ITS HIGHEST OR LOWEST POSITION BEFORE THE PRESSER-FOOT CLUTCH IS ENGAGED.

The needle and bobbin threads should be locked as near as possible in the center of the thickness of the bottom strip of

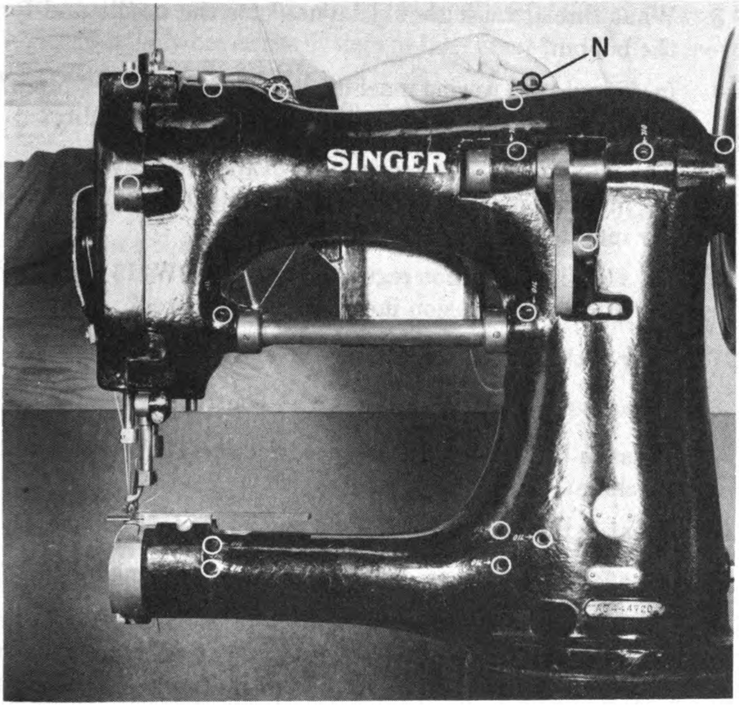


Figure 98. — Oiling points and adjustments at the front of the Class 97 machine.

webbing, whether the work be of two, three, four, or more plies. This means that the bobbin threader has tighter tension than the needle thread.

QUIZ

1. (a) What does class and variety mean when describing a sewing machine needle?
2. (a) When describing the size of needles (the larger the number the smaller the eye) (the smaller the number the larger the eye) (the larger the number the larger the eye).
(b) When describing thread sizes (the larger the number the smaller the thread) (the larger the number the larger the thread) (the smaller the number the larger the thread).

3. What thread twist should be used for the needle and for the bobbin?

4. (a) Should the sewing machine be oiled? If so, how often?
   (b) How much oil is necessary for the hook assembly?

5. The maximum speed recommended for the 112W115 sewing machine is (1000) (2000) (3000) (4000) (5000) stitches per minute.

6. (a) How is the tension regulated on the 112W115 machine?
   (b) How is the tension increased? Decreased?

7. How is the tension on the bobbin threads regulated?

8. What is the purpose of the thread controller spring?

9. What is the recommended speed for the 111W150 sewing machine?

10. What is the purpose of the gib on the feed eccentric?

11. What speed is recommended for the 31-15 sewing machine?

12. The feeding mechanism of the 31-15 machine should be timed so that the feed dog completes its feeding movement when the thread take-up lever is at its (midpoint) (lowest point) (highest point).

13. (a) What is the Model 143WSV8 sewing machine commonly called?
    (b) What is this machine used for?

14. How is the bight or zigzag stitch regulated on the 143WSV machine?

15. To time the sewing machine hook, remove the throat plate and turn the balance wheel toward you until the (upper) (middle) (lower) timing mark on the needle bar is just visible at the end of the needle bar frame.

16. (a) What use is made of the 114W202 sewing machine?
    (b) At what maximum speed is it designed to operate?

17. Why is the hook driving shaft and the shaft of the sewing hook splined?

18. (a) What is the Class 97 sewing machine used for?
    (b) What is its maximum recommended speed?

19. (a) The wax compartment should contain enough wax to (partially cover the eyelets in the threat posts) (fully cover the eyelets in the thread posts).
(b) What is the purpose of the water compartment?
(c) The water compartment should be (full) (3/4 full) (1/4 full) at all times.

20. Are parachute harnesses sewn with waxed thread? Give reason for your answer.

CHAPTER 3

PACKING AND RIGGING

Although each parachute packed has already been inspected, the final examination has not been made when the packing operation is complete. Packing is not merely a matter of inserting a parachute into its container. **PARACHUTE PACKING IS A SYSTEM — A COMBINATION OF PACKING, INSPECTION, AND RIGGING.**

It cannot be overemphasized that the design and construction of a parachute is such that when properly packed and rigged, no doubt will at any time exist as to its perfect function.

Packing is essentially the same for all standard parachutes, although the external (outside of pack) rigging will differ somewhat. If you understand thoroughly a reliable packing procedure, you will be able to pack any chute of any type.

All data deemed necessary to familiarize you with packing and rigging processes for all service parachutes, with and without pararaft, with regular and oversize harnesses, will be furnished in this chapter. We shall also consider a number of particular conditions which affect parachute operations and rigging procedures.

The following is a listing of the order in which we shall discuss the packing and rigging of service parachutes. This listing also contains various acceptable rigging possibilities.

1. QAC — 24- and 28-foot canopy
    - A. 24-foot canopy, without raft and with regular harness.
    - B. 24-foot canopy, with raft and with regular harness.
    - C. 28-foot canopy, without raft and with oversize harness.
    - D. 28-foot canopy, with raft and with oversize harness.
    - E. 24- or 28-foot canopy, without raft; with quick-fit harness.
    - F. 24- or 28-foot canopy, with raft and quick-fit harness.
2. SS — 24- and 28-foot canopy
    - A. Same rigging pattern as outlined for QAC.
3. QAS — 24- and 28-foot canopy
    - A. Due to the trend of this parachute fading from service use, but one rigging possibility will be considered.
    - B. 24-foot canopy, without raft and with regular harness.
4. SB — and 24-foot canopy
    - A. Same rigging pattern as for the QAC and 24-foot canopy.
5. Training Outfit — 24- and 28-foot canopy
    - A. TB and 28-foot canopy with regular training harness.
    - B. TR and 24-foot canopy.

PACKING TOOLS

Parachute packing tools are highly specialized implements — this does not imply that they are complicated.

Your parachute tool kit, as a minimum requirement, must include one LONG BAR, one FID, one SHROUD-LINE HOOK, one SHROUD-LINE HOLDER, two PACKING CORDS, three SHOT BAGS, and three LOCKING PINS.

The LONG BAR, illustrated in figure 99, is used for smoothing out canopy folds. It is made of duralumin, and is 1¾ x 18 x ¼ inches in size. Notice that the ends are rounded and smoothed to prevent snagging of fabric.

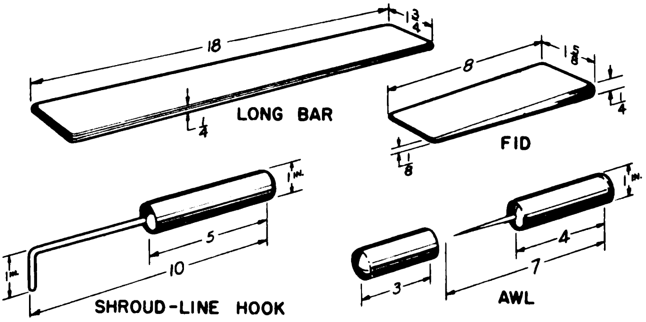


Figure 99. — Packing tools.

A FID, also shown in figure 99, is your packing stick, fitting snugly into small pockets on the corners of the container to facilitate tucking in of corner flaps. It also may be used for smoothing down the main flaps of the container when the pack is closed.

The third tool, shown in figure 99, is a SHROUD-LINE HOOK, used to draw shroud lines into hesitator loops in the container. The manufactured article is made from 0.130-inch steel wire with the end rounded into a ball-shape. The handle is made from either metal or wood.

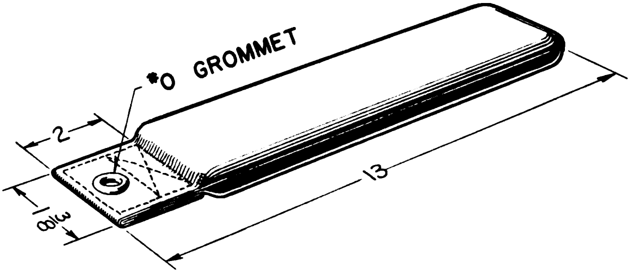


Figure 100. — Shot bag.

Closing cords about three feet in length are used to pull the side flaps of the container together and to draw the locking cones up through the metal grommets and end-tabs. Pilot chute shroud lines make excellent pull-up cords.

One type of shot-bag is illustrated in figure 100. These must be sufficiently heavy to weight down the canopy or parts of the harness. They also aid in keeping canopy gores folded and smoothed down during packing.

Shot bags are made of aircraft canvas. Two seams along the long end divide the bag into two compartments of equal size, which are filled with washed sand or lead shot. When not in use, the bag may be hung at the side of the packing table or on the bulkhead.

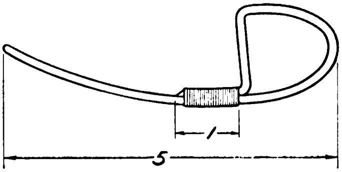


Figure 101. — Temporary locking pin.

The shroud-line holder, pictured in figure 102, is a practical device for holding the shroud lines while the parachute is being inspected or packed. This implement is made from 1/8-inch aluminum alloy with rounded and smoothed edges.

Sail needles are too large and bulky for use as a regular tailor's needle, but are indispensable for working with heavy material. The most popular sizes of sail needles — 14 and 16 — are used for most parachute tacking operations, and will receive cord as large as number 9.

A sewing palm is essential for heavy sewing. This instrument is a leather shield with a metal thimble located in such position that when slipped on the hand, the thimble is over the palm. The sewing palm, shown in figure 103, is available in either right- or left-hand models.

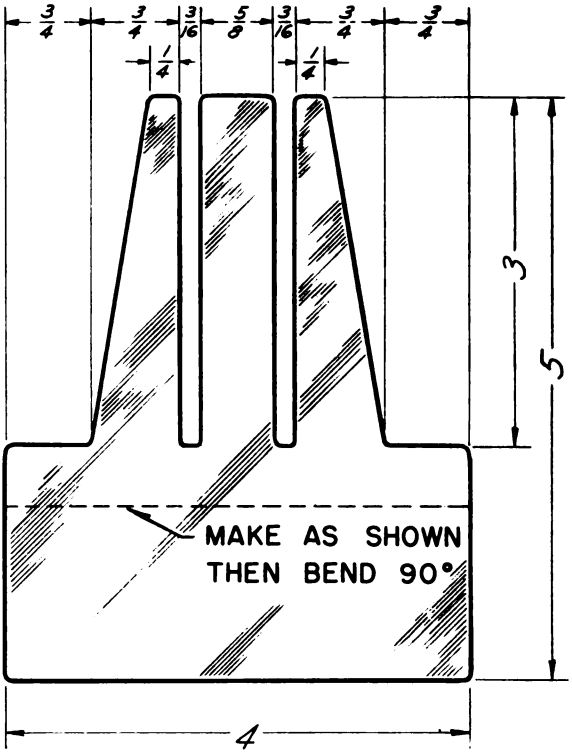


Figure 102. — Shroud-line holder.

REMOVING DIPS AND TWISTS

Tangles result each time a parachute, not in a packed condition, is jumped, dropped, or handled carelessly. Before a chute is placed in the dry locker for airing, and before a chute is packed, it must be carefully inspected for tangles, dips, and twists.

A DIP means that the container and harness has made a complete turn either up or down directly between both groups of shroud lines, as pictured in figure 104.

When the container and harness pass in and around the other lines, the result is called a *twist*. ALL TWISTS MUST BE REMOVED BEFORE ATTEMPTS ARE MADE TO ELIMINATE DIPS.

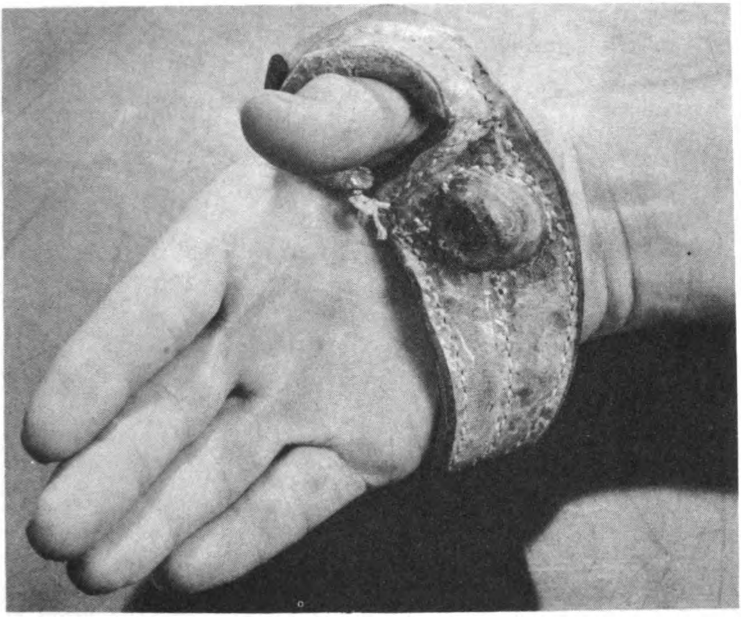


Figure 103. — Sewing palm.

Temporary locking pins hold the container closed over the folded canopy so that rip-cord pins may be inserted. The manufactured tool, shown in figure 101, is made of 0.081-inch corrosive-resistant non-magnetic steel wire. The end is rounded to a ball shape. The loop may be made by soldering copper serving wire.

One method of removing twists is called the "Up and down — right and left" method, the other known as the "One-line" method.

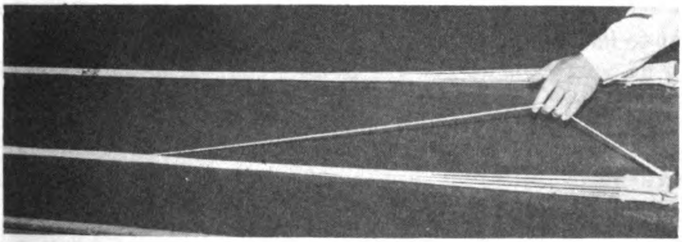


Figure 104. — A "down" dip.

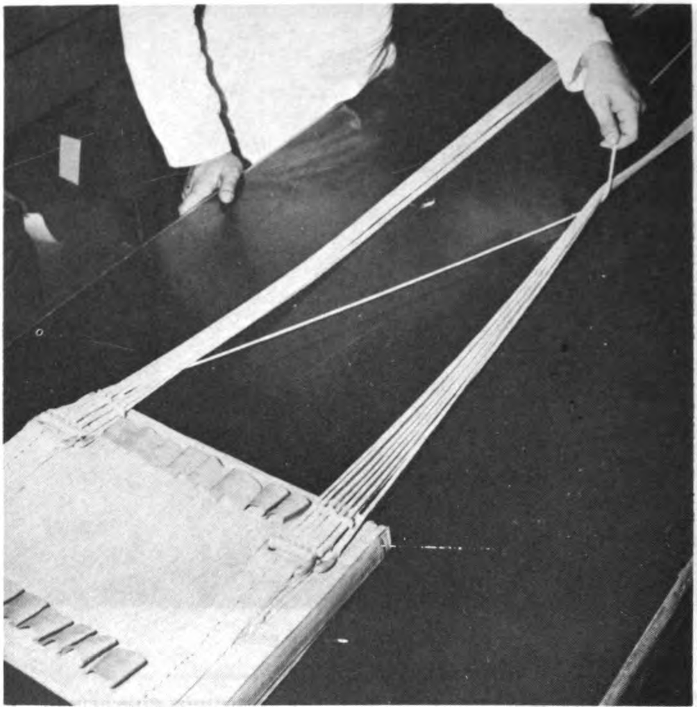


Figure 105. — Grasp fouled line where it crosses group.

"RIGHT AND LEFT" METHOD

To remove a single right twist — in which a shroud or group of shrouds from the left group of lines passes in or around the right group — grasp the shroud in question at the point of contact with the right group, as shown in figure 105. Pass this shroud around and behind the container and harness, from right to left, thus placing or returning it to its proper group, as may be seen in figure 106.

The single left twist is just the opposite, since it runs from the right group and passes in or around the left group as shown in figure 107.

The single left twist is removed in the same manner as the right twist, except that the shroud line concerned is passed around and behind the container and harness, from left to right.

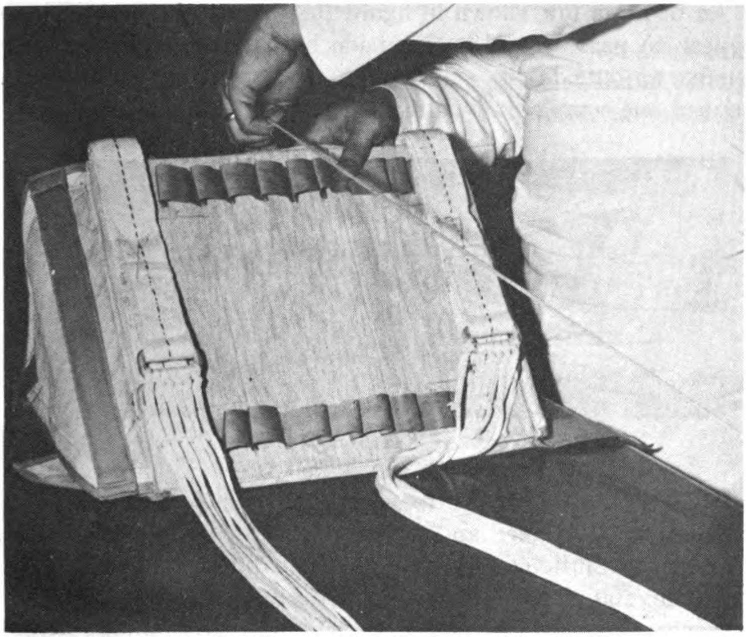


Figure 106. — Pass shroud around container and harness to proper group.

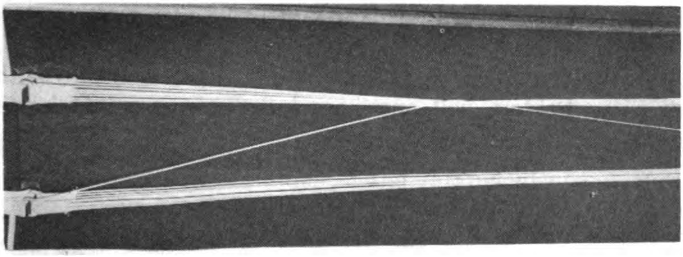


Figure 107. — Single left twist.

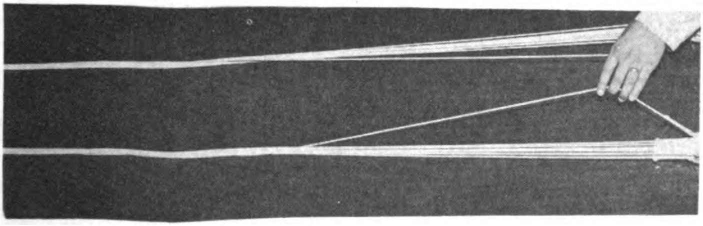


Figure 108. — An outside dip.

An OUTSIDE DIP, shown in figure 108, is one where two lines appear to pass around and outside both group of lines. To remove an outside dip, simply turn the container and harness upward one complete revolution.

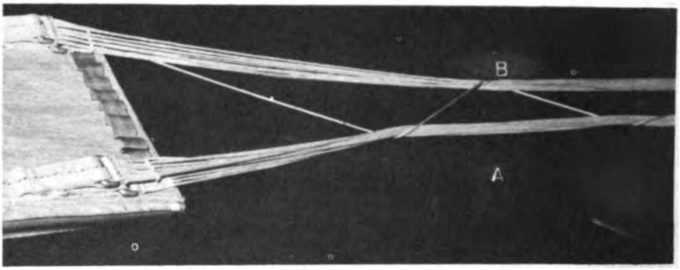


Figure 109. — A combination of fouls.

When the lines appear to pass around the inside of both groups, the container and harness is turned downward one complete revolution to remove the inside dip.

Figure 109 illustrates a combination of fouls. There is evidence of two right twists and one left twist shown here. Study this picture carefully; note that the visible twists are not a continuation of one line.

In figure 109, the right twists show two shrouds twisted simultaneously, in (A); the other foul being but a single right twist, (B).

A veritable nightmare of twists and dips is displayed in figure 110. Seldom will any parachute become so fouled in service as that illustrated, however.

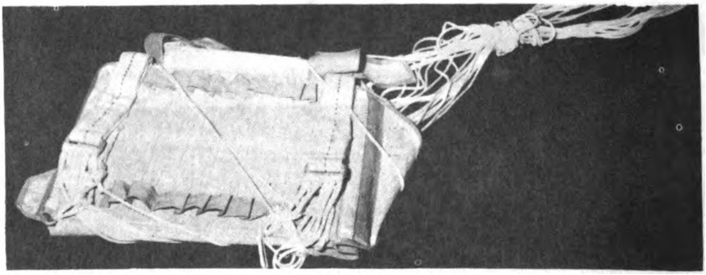


Figure 110. — A "nightmare" of fouls.

"ONE-LINE" METHOD

The "one-line" method of removing tangles is not as efficient as the method just explained. This may be called a "blind" method, since no understanding or recognition of the fouls encountered is required in untangling the twists.

Procedure in this method consists of holding one line while throwing all right and left twists up and over the forearm.

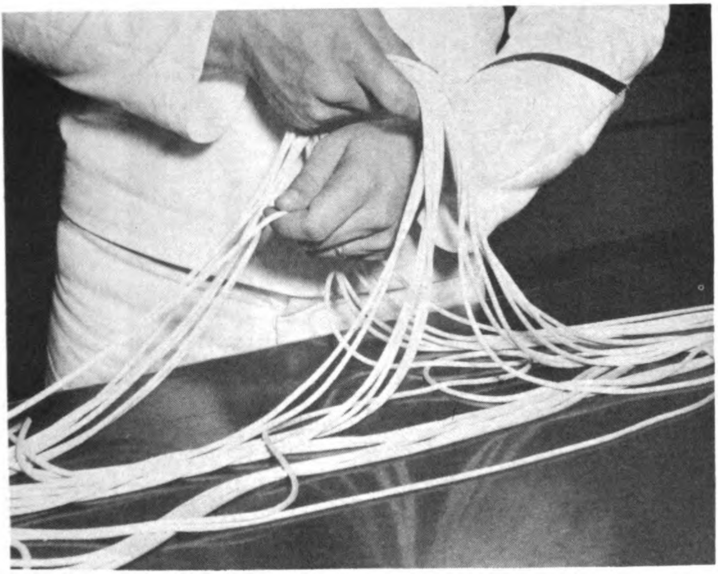


Figure 111. — "One-line" method.

The loops are opened, and the container and harness drawn through, thus clearing much of the entanglement. Figure 111 shows the fouled lines being passed over the hand as one line is being followed through.

DRY LOCKER PROCEDURE

If at all possible, arrange a system whereby your parachutes will be readied for packing while in the dry locker. A great deal of time and effort will thus be saved.

Hanging a parachute to dry is an extremely simple operation, but several important items concerning this procedure are worthy of attention.

Carry an unpacked and open parachute in such a manner so as not to catch the canopy on obstructions. Do not allow the canopy to drag along the deck. A proper method of carrying an unpacked chute is illustrated in figure 112.

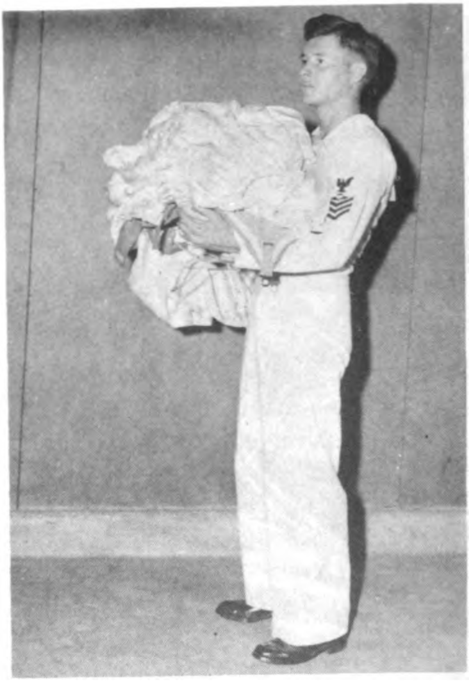


Figure 112. — Proper method of carrying an unpacked parachute.

Secure the rip cord in a hook snap so that it will not be misplaced, and secure the pilot chute, as demonstrated in figure 113, with two locking half-hitches.

The pilot chute may be left hanging outside of the canopy or dropped inside the container. However, the latter method prevents its becoming fouled on other chutes.

When securing the peak of the canopy to the hoisting line, snap it onto the lower pilot chute connector cord, as shown in figure 114. Avoid snapping the unit into any of the peak suspension lines.

When the canopy has been raised to a point where the skirt

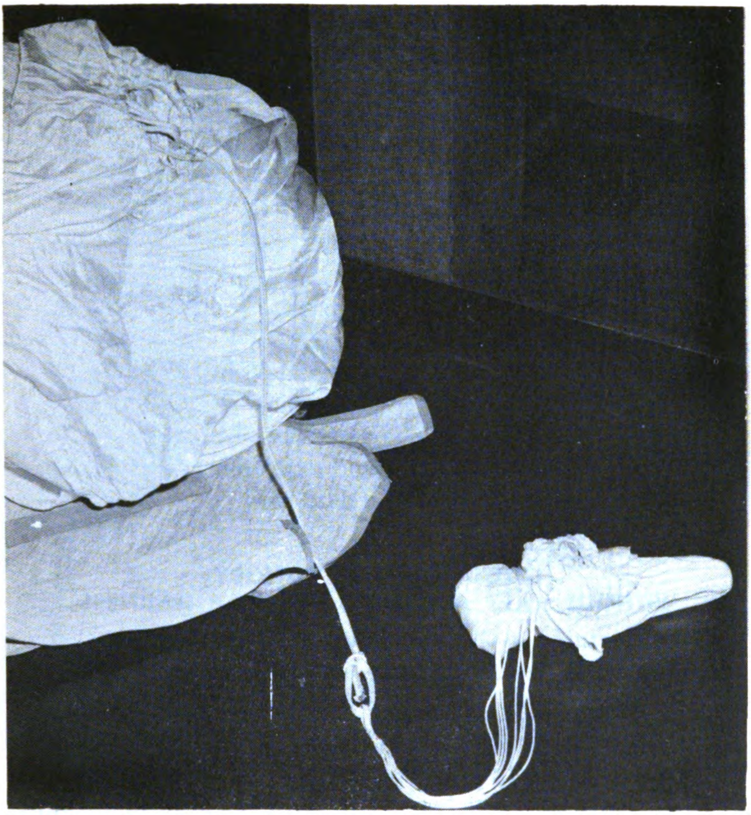


Figure 113. — Method of securing pilot chute prior to airing the parachute.

is at eye level, GRASP THE SKIRT HEM AND SHAKE OUT THE FOLDS. This allows circulation of air throughout the entire canopy.

PACKING AND RIGGING THE QAC PACK

The QUICK-ATTACHABLE CHEST TYPE PARACHUTE will be considered first because it is the simplest and easiest to pack and rig. All other service chutes are packed more or less as the QAC. Later, in discussing the variations of packing and rigging other types of parachutes, reference will be made to the QAC where similar operations are encountered.

The following is a list of the fundamental steps in parachute packing and rigging:

1. Clean the table.
2. Lay out tools and equipment.
3. Lay out parachute.
4. Hook up.
5. Inspect.
6. Whip and fold canopy.
7. Unhook.
8. Stow shrouds.
9. Stow canopy.
10. Partially close pack.
11. Insert pilot chute.
12. Completely close pack.
13. Safely tie locking pins.
14. Hook up opening elastics.
15. Make tests and adjustments.
16. Sign packing data card.

QAC — 24-FOOT CANOPY WITHOUT RAFT AND WITH REGULAR HARNESS

Clean the table so that no abrasive foreign matter will come in contact with the canopy and have tools and assemblies ready in order of use.

Lay out the parachute (lift web assembly not tacked in position). If the shroud lines are chained, slip the securing hitch and unchain. The helper will carry the peak to the opposite end of the table until the chute is fully extended as shown in figure 115, after which the lift web assembly is hooked up.

Check the shroud lines for fouls, then obtain the proper parachute pack for QAC and a 20-foot canopy. Check the container for defects. Place the lift web assembly in position, as illustrated in figure 116, and then fasten it to the container (see figure 117). Do not interrupt the "fair lead" of the pack opening elastics.

Notice the one-inch stenciled word "TOP" on the center of the safety strap to aid in assuring correct hookup of the pack.

In the event the safety strap is not provided with a small signalling code pocket, refer to NAF Blueprint 47713-7, revision number 9, of 27 November 1946. Technical publications have been issued concerning this modification.

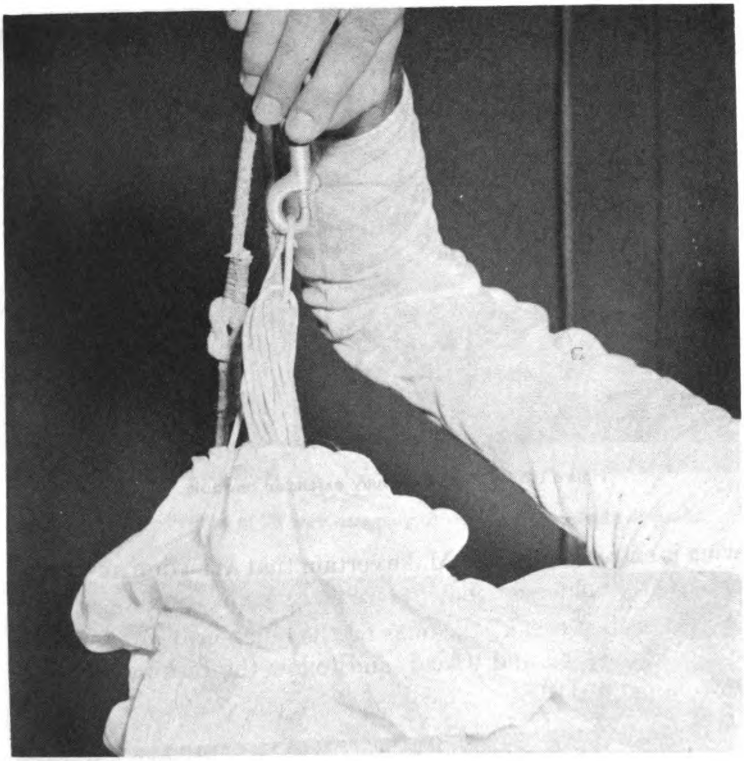


Figure 114. — Securing the peak for hoisting.

With the lift web assembly positioned but not tacked to the container, as shown in figure 118, the links on the opposite end of the lift web assembly should assume an approximate position as shown. The links should never be permitted to extend beyond the edge marked (A).

Check the length of the safety strap illustrated in figure 119. If the strap is too short and the snaps fail to reach the edges, the bottom part of the snaps will tend to point outboard, thereby making a poor arrangement and adding extra wear on the pack to render eventual "hookup" difficult.

LIFT WEBS TO CONNECTOR LINKS

One of the most important sewing procedures is the "METHOD OF ATTACHMENT OF LIFT WEBS TO CONNECTOR LINKS." This

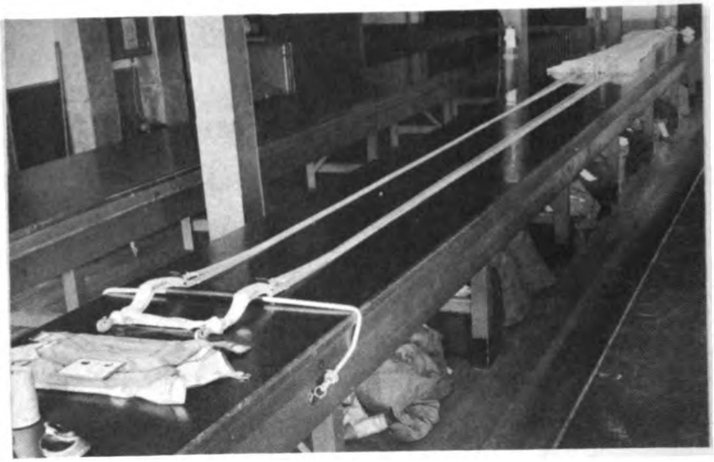


Figure 115. — Parachute fully extended on table.

sewing is extremely vital. Make certain that ALL FOUR SEWINGS are correctly made and that the webbing is not frayed.

To make the "break" tackings on the quick-connector snaps, use 6-cord doubled and waxed, and follow the tacking pattern shown in figure 119.

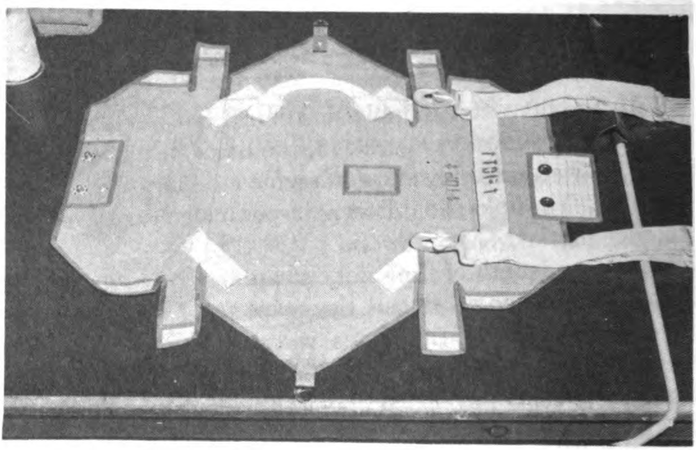


Figure 116. — Lift web assembly laid out to receive container.

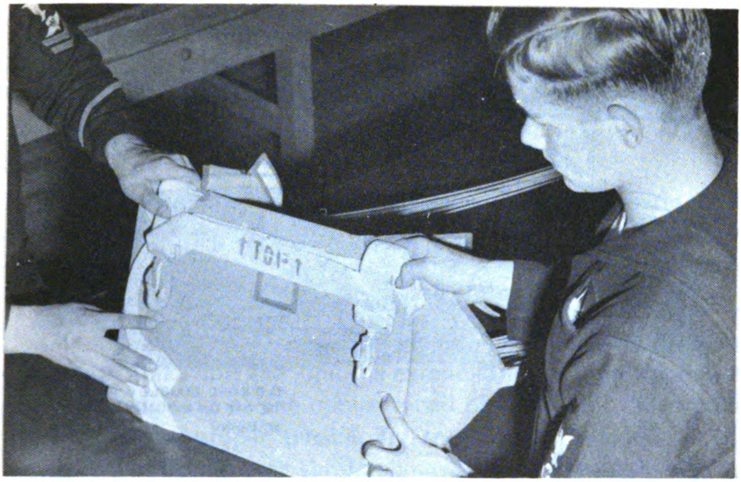


Figure 117. — Position of lift web assembly as viewed from outside of pack.

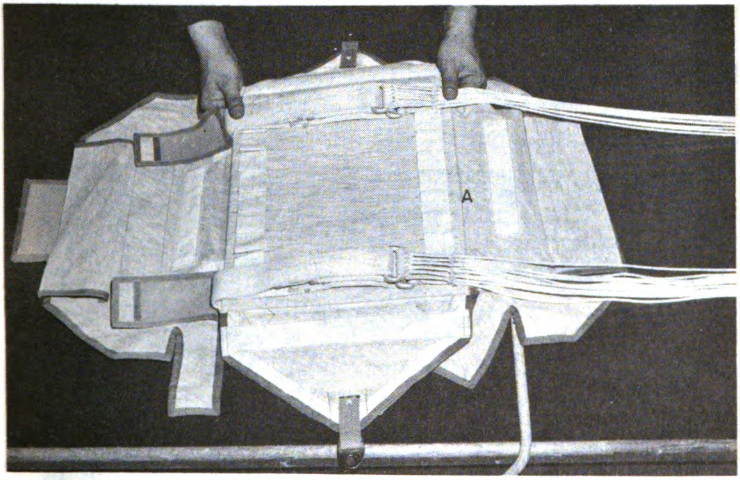


Figure 118. — Position of lift web assembly inside of container.

Notice that each tacking of the snap in question is made in one continuous operation which ties off on the inboard side of the webbing with a surgeon's knot. In cutting off, leave 1/4-inch bitter ends.

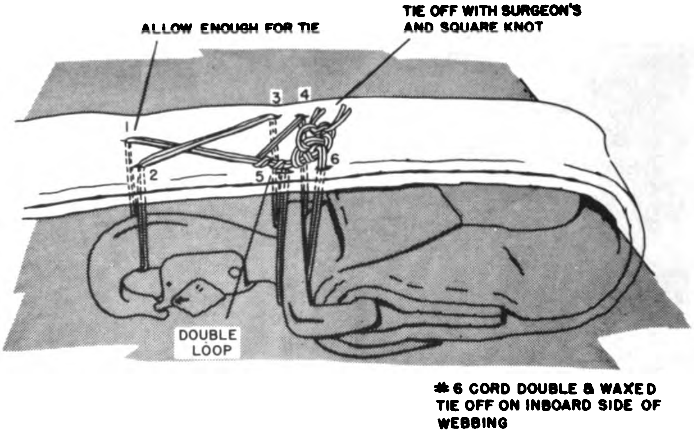

ALLOW ENOUGH FOR TIE
TIE OFF WITH SURGEON'S AND SQUARE KNOT
1
2
3
4
5
6
DOUBLE LOOP
#6 CORD DOUBLE & WAXED TIE OFF ON INBOARD SIDE OF WEBBING

Figure 119. — QAC quick-connector snap tacking pattern.

Six-cord is the strongest "break" tacking used on service chutes.

Drive the sail needle straight through the material close to the hardware. Draw up tightly so that the hardware cannot shift. Make sure the loops formed around the adapter part of the snap — at points 3-4 and 5-6 — are evenly spaced from the center line of the snap. Tack both snaps securely, bringing each out to the edges of the pack.

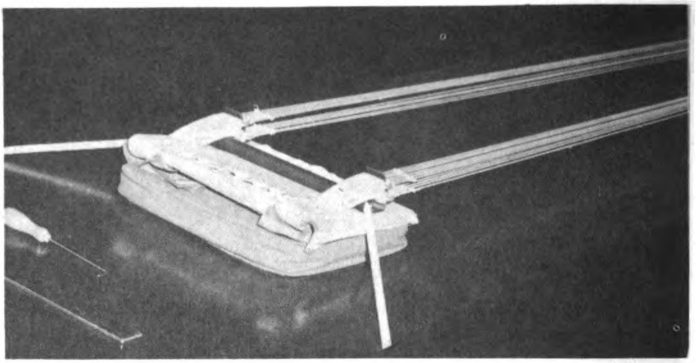


Figure 120. — Hook up the chute!

Hook elastics to the eyes of the pack and slightly pinch the hooks with flat-nose pliers. This prevents loss before the opposite end of the elastics are hooked to the side of the end flaps.

Never use over-age elastics. Consult the latest applicable technical publication concerning parachute bungee or shock cord.

All the latest 24-foot parachute canopies are made with 20-foot-length shroud lines. The total of 14 to 16 hesitator loops is considered adequate for storage of these shroud lines.

Place the parachute under tension as shown in figure 120.

The flat hooks of the spreader bar are passed up through the connector links and the chute is extended by pulling the extension webbing taut at the opposite end of the table. The chute is held at the proper tension by securing a grommet in the extension webbing over the hook screwed to the table top, as demonstrated in figure 121.

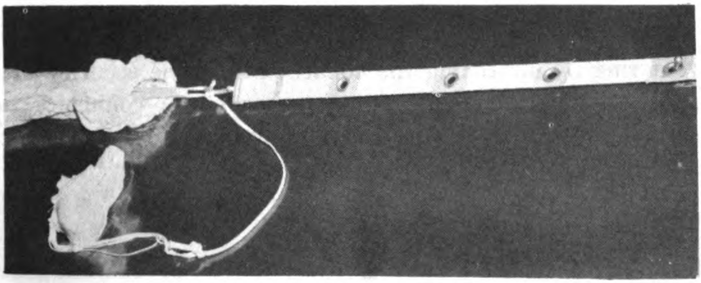


Figure 121. — Extension webbing holding chute under tension.

Notice the seat cushion (figure 120) which was placed under the container and lift web assembly immediately before the chute was hooked up. This cushion presents a good packing base, cushioning the hardware and protecting the table surface.

With the parachute under tension, commence the inspection. Check the shroud lines for defects and for proper rotation or continuity, as shown in figure 122.

Occasionally on new parachutes, a shroud line will be found sewn to a particular link which is out of rotation. Such chute should be turned in to a major overhaul station.

Inspect the general outward condition of the canopy, especially in the peak area where soiling usually occurs.

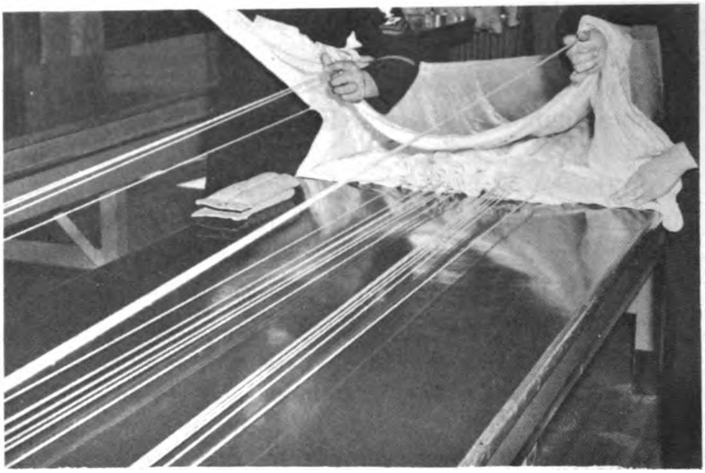


Figure 122. — Checking rotation of shroud lines from skirt to links.

Check the vent collar for security, and the elasticity of the vent ring by stretching the collar. Check the security of the pilot chute attachments to the pilot chute connector cord (bridal cord), making sure that the lower and upper connector cord loops are of the proper size — approximately three inches — or the width of the palm of your hand.

Check the ties to make certain that bowline knots have been used.

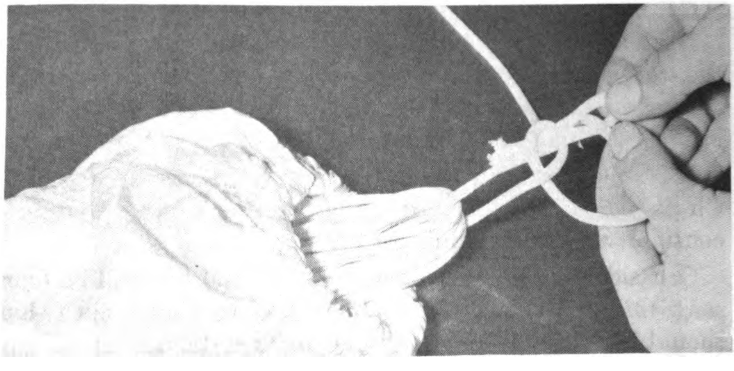


Figure 123. — Unsecuring the bowline-knot.

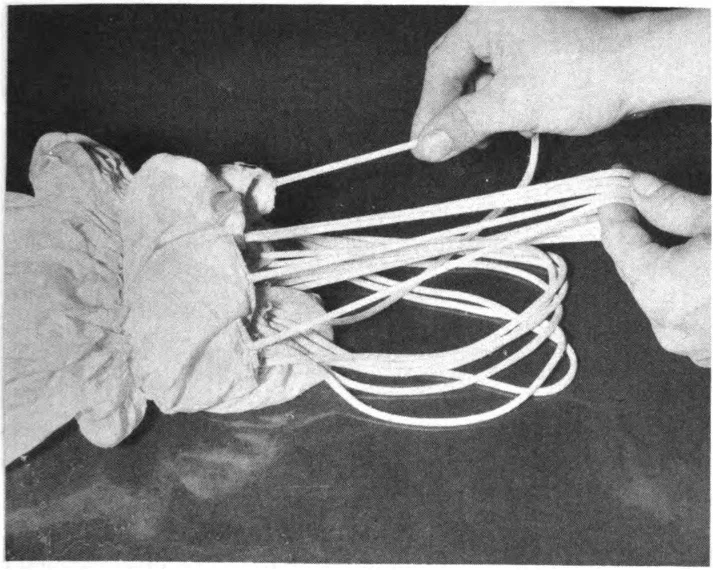


Figure 124. — Segregating the suspension lines for passage of the connector cord.

Replace the old short cord with the new long cord by consulting steps illustrated in figures 124, 125, and 126.

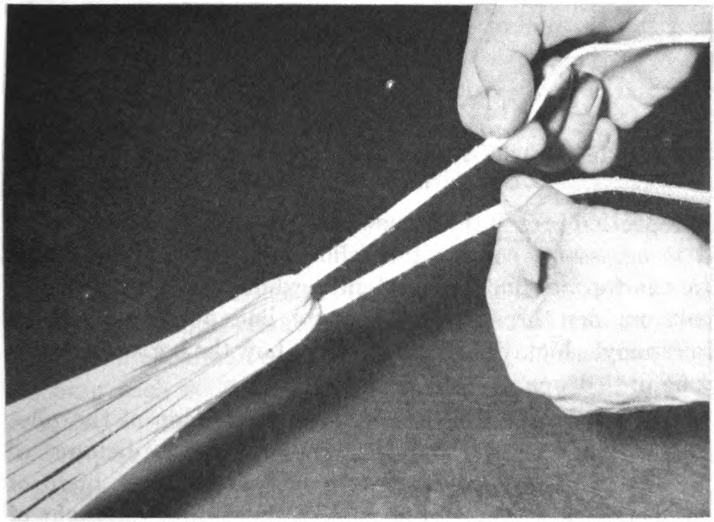


Figure 125. — Pass one end of the bridal cord through the opening drawing sufficient cord through for a three-inch bight.

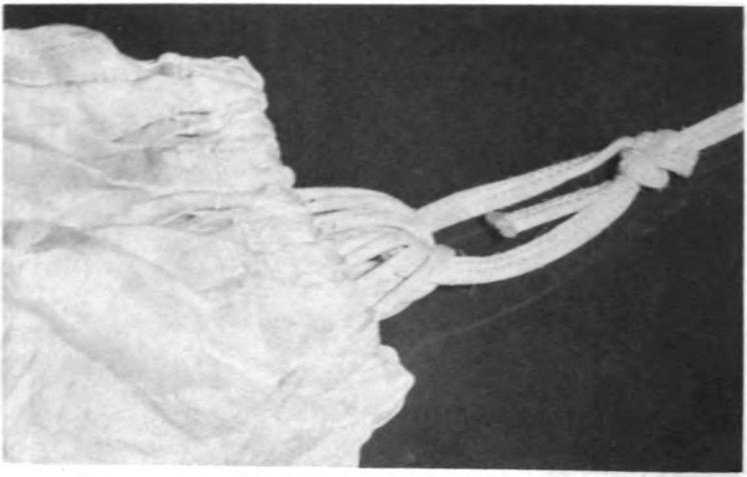


Figure 126. — Make a regular bowline knot and draw it up evenly.

According to new blueprints, a different type of bridal cord is coming into use. The new cord is longer; a double-type III shroud line zigzag sewn together along the entire length, and has no loop sewn in one end. It is simply a straight piece of double shroud sewn together.

Untied, the new bridal cord measures 42 inches, while the tied length is approximately 30 inches, which makes it twice as long as the present cord.

RENEWING PILOT CHUTE CONNECTOR CORD WITH NEW TYPE

If inspection proves that renewal of the pilot chute connector cord is necessary, consult the following steps for procedure: Untie the top bowline and bottom bowline, the latter securing the bottom loop through the suspension lines at the peak of the main canopy. Figure 123 demonstrates how the bottom bowline may be untied.

Pass the remaining bitter end through the loop of the pilot chute, drawing through sufficient cord so that a distance of 30 inches can be measured between the bottom of the bight of the connector cord at the peak and the bottom of the bight of the pilot chute. A bight of approximately three inches — the same as the bottom bight — should be evident, together with at least one inch of bitter end remaining.

The next operation consists of whipping and folding the canopy so as to condense it to a narrow length which can be easily stowed in the parachute container.

In beginning the operation, grasp the two top inboard lines and face the container, simultaneously raising each line to a height which will permit observation of the canopy interior. Figure 127 illustrates this step.

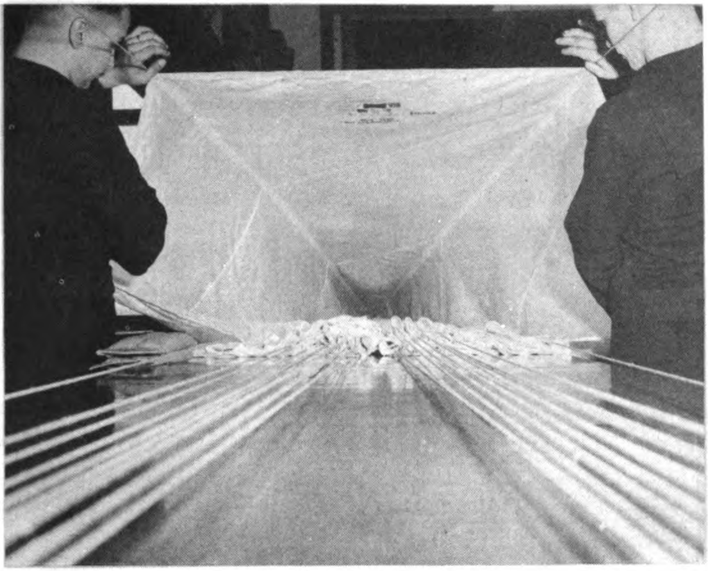


Figure 127. — Packer and helper in position to whip and fold canopy.

Each line in turn is consecutively brought up into the packer's and helper's hands, thereby making each fold until a total of 12 lines for each man are accounted for. Hold each line firmly, grasping each so that the skirt hem is brought into correct position, turning, if necessary, so that all resultant folds will be of equal length.

Figure 128 illustrates the shroud lines taken up, with two gores remaining to be folded. Top and bottom gores are shown stretched across the table.

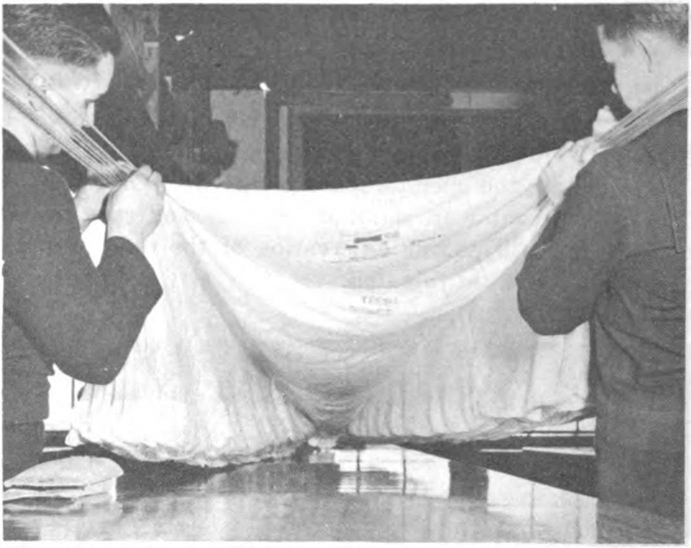


Figure 128. — Shroud lines taken up during whipping operation.

To make the last two folds, swing all other folds out beyond the edges of the table. The packer grasps the center of the top gore, the helper the bottom, and the folds are made by bringing the center of the top and bottom gores to the outside so that the shroud line groups meet in the center, as shown in figure 129.

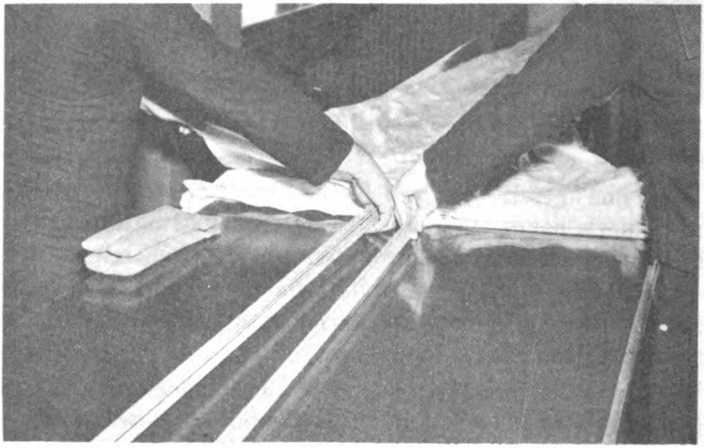


Figure 129. — Making the last two folds.

Following this operation, little difficulty should be experienced in making first-class folds. The trick is to temporarily get other folds out of the way so that the final two may be made with as little disarrangement as possible to the others.

The shroud lines of each group are inserted in the respective slots of the shroud-line holder, and a shot bag is placed on the lines to hold them in position (see figure 130).

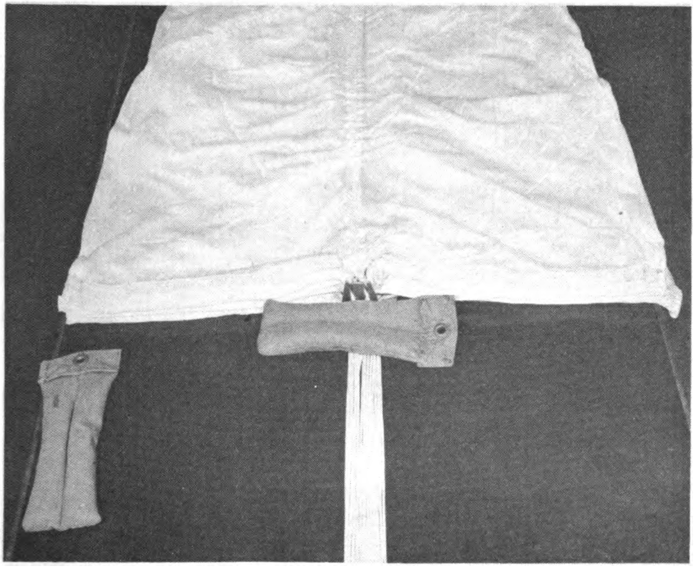


Figure 130. — Shroud lines held in position by use of shroud-line holder and shot bag.

The bottom folds are next checked by throwing one side of the folds, with the exception of the bottom fold, over on top of the others. Figure 131 shows the helper's side thrown over to reveal the fold to be straightened. This fold is generally in need of more straightening than the opposite side since it was last to be drawn underneath.

When the bottom folds have been aligned and all others are neatly in position, the skirt must be straightened. In performing this step, the packer makes adjustments from the peak while the helper remains at the skirt to direct movements of the line until all are even at the skirt. Usually a few quick back-and-forth movements of the peak suspension lines will equalize the skirt which has been slightly drawn out of alignment by tension on the chute.

Count off the gores and align the skirt preparatory to folding the canopy in thirds as shown in figure 132.

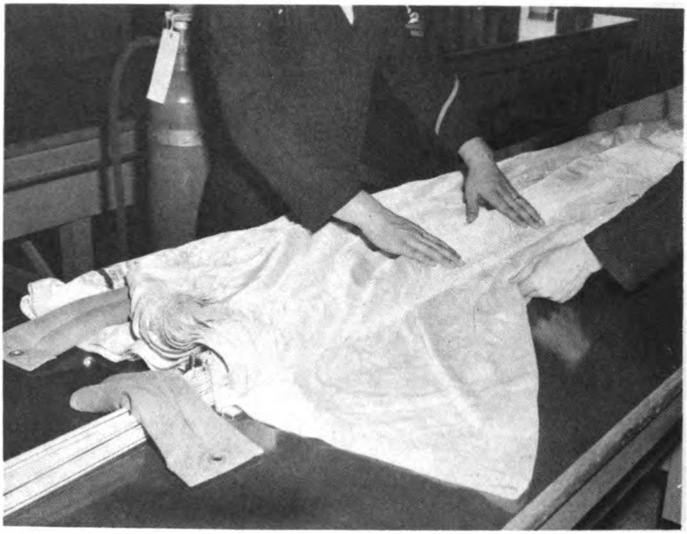


Figure 131. — Straightening one side of the bottom folds.

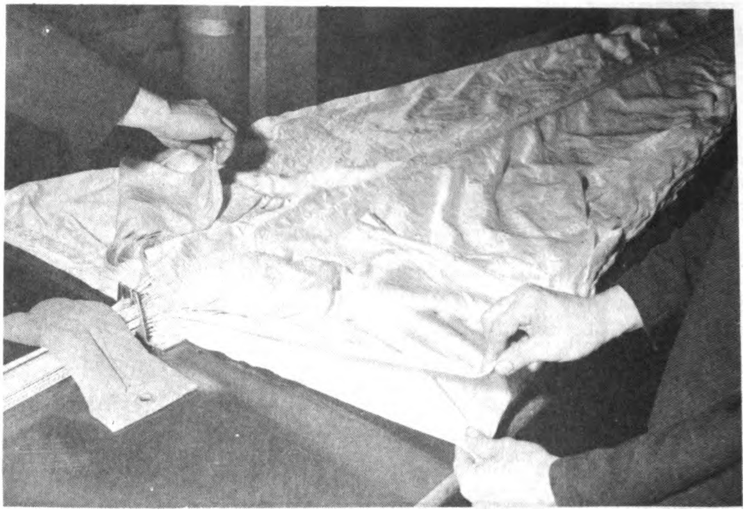


Figure 132. — Counting the gores and aligning the skirt.

Fold the canopy in thirds, the helper and packer alternately throwing sides. Care must be taken not to cause too great disarrangement of the skirt, and the folds should be brought straight across so that the skirt hem, now in thirds, lines up perfectly.

The folds are continued toward the peak for a distance of at least three-fourths of the canopy length, and shot bags are laid across the folds to hold them in place until the canopy is placed on the container.

The shot bag previously serving to hold the shroud lines is now taken up and placed a short distance up from the skirt, and a second shot bag is set midway up from the skirt. This step is illustrated in figure 133.

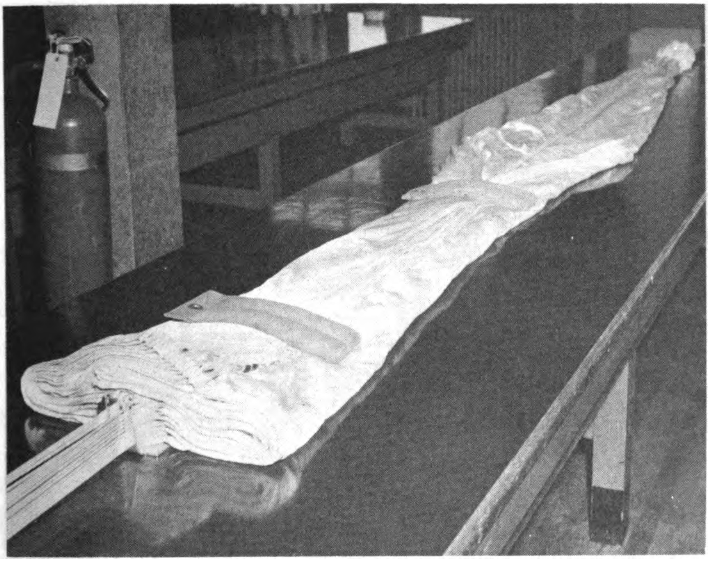


Figure 133. — Canopy folded in thirds and held in place by shot bags.

The helper next tends the container as the packer disengages the spreader bar and prepares the container for stowage of the shroud lines. To stow shroud lines in the hesitator loops of the container, consult the following described and illustrated steps.

With the shroud line hook in the right hand, grasp the entire

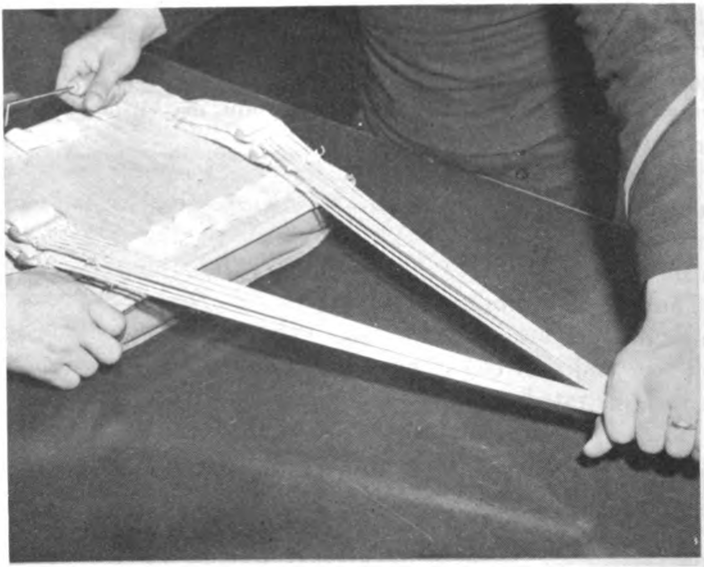


Figure 134. — Stowing shrouds, step one.

group of shroud lines with the left hand at a point illustrated in figure 134.

Bring the lines in a bight up to the first hesitator loop, drawing them through to the edge of the container as shown

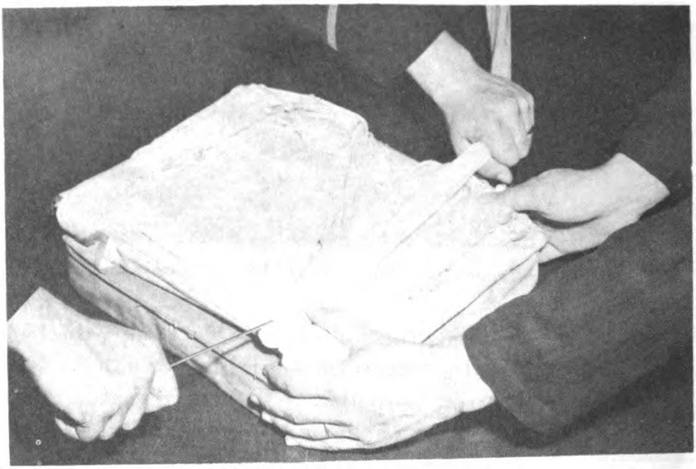


Figure 135. — Stowing shrouds, step two.

in figure 135. Notice how the main group of lines is running along the outboard edge of the container to the canopy.

If the lines have been grasped a sufficient distance out from the container, as recommended in figure 134, you will be able to properly arrange the shrouds leading from the links in the bottom of the container, as figure 136 suggests.

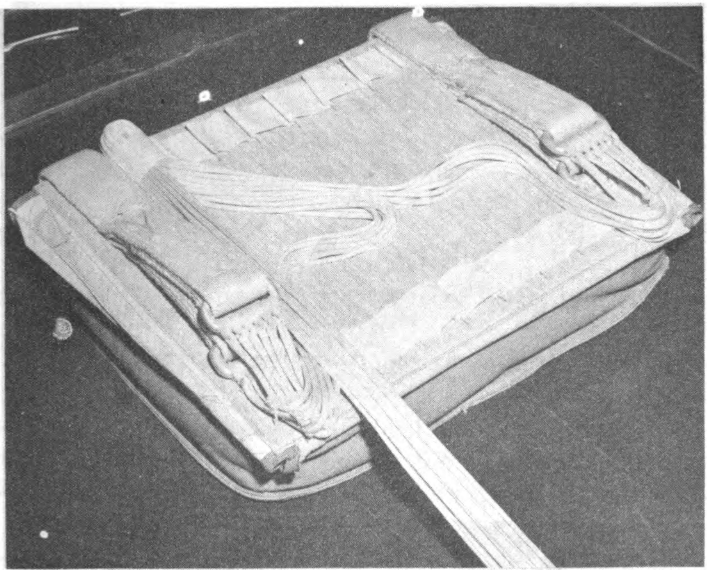


Figure 136.— Stowing shrouds, step three.

It is important that shroud lines be stowed in the container so that too much line will not be left over when the last bight is taken.

Figure 137 shows an inadequate amount of shrouds drawn into the first hesitator loop. Notice how drawn "off-line" the lift webs appear because of this initial error. If this mistake were ignored, too great an amount of line would remain.

For comparison, look again at figure 138 and notice how smoothly the lines lay in the bottom of the container, and especially the manner in which they meet in the center. Care has been taken so that none of the excess shrouds are crowded or thrust back beneath the lift webs.

When you draw each group of lines through the hesitator

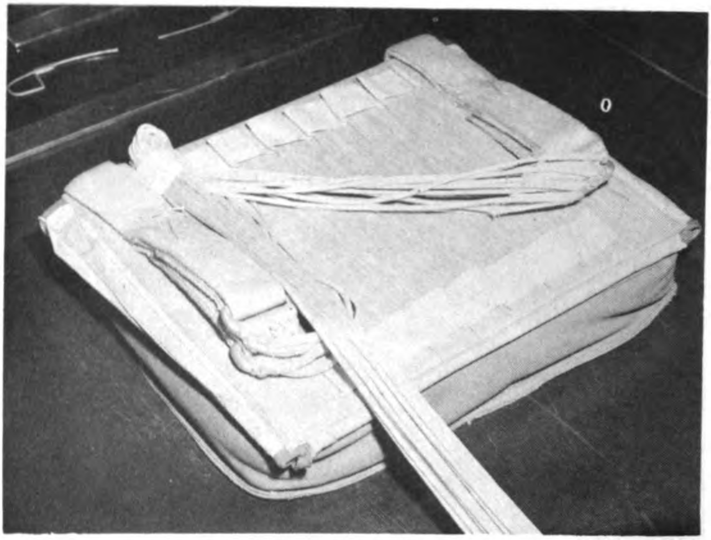


Figure 137. — Inadequate amount of shroud line through hesitator loop.

loops, your helper should hold them even with the edge of the container. Do not permit the bight to be pulled beyond the edge of the container, or allow the lines to slip back. Figure 138

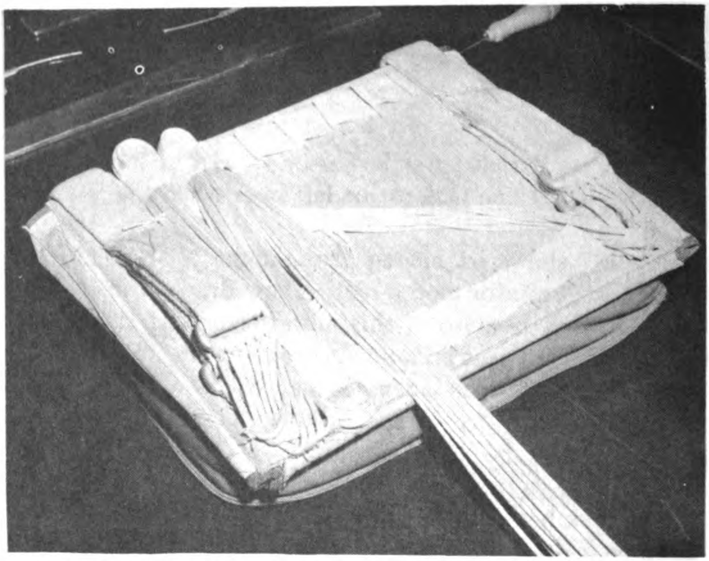


Figure 138. — Second and third bights stowed in hesitator loops.

illustrates the second and third bights stowed in the hesitator loops.

Notice how straight each line appears to be lying within the group. The packer must exercise great care not to create simple twists in the lines through turning his hand a quarter or half turn each time he grasps the lines for a new bight. As each new bight is brought up to the hesitator loop, his palm must remain constantly down while he is stowing lines.

The shroud line hook must remain on the bottom of the container as each new bight is drawn through the loop. Otherwise, the lines will be dropped and not carried the proper distance, creating excessive slack in certain lines at the completion of the stowage. Slack lines invite a burning action on opening shock.

Figure 139 demonstrates a total number of six bights taken through hesitator loops. Note how each bight has been evenly drawn up to the edges of the container. No twists exist due to the packer having held his hand steadily in one position as each bight was taken.

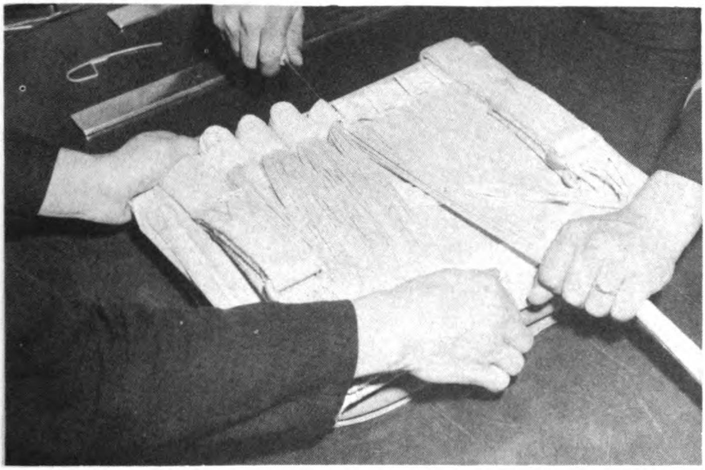


Figure 139. — Six bights taken in hesitator loops.

The left group is not twisted around the right group, and vice versa. To prevent such occurrence, a beginner may walk up to the canopy, place his shroud-line hook between the groups, and walk back to the container, thus clearly separating the groups on up to the hesitator loop. In such manner he may observe his progress insofar as keeping twists from his lines is concerned.

The "hook" need not leave the packer's right hand when marking either the top or bottom bights, and he handles the shroud lines as little as possible. Never slide the hand along shroud lines.

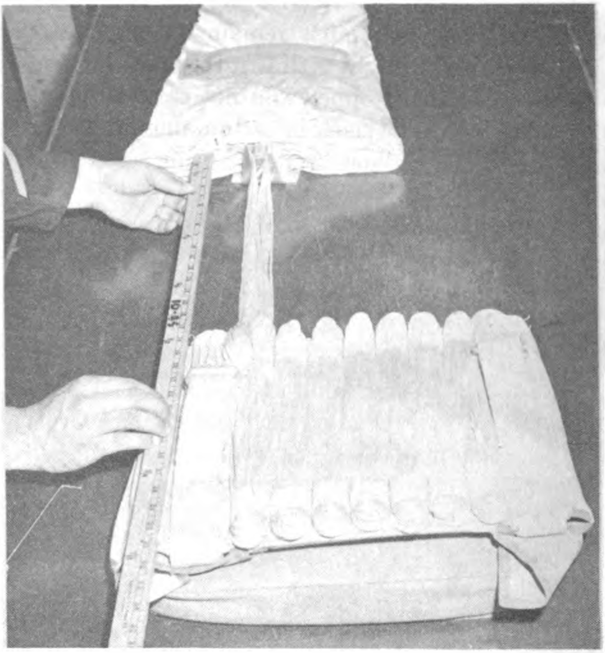


Figure 140. — Checking the distance from last bight to hem.

When all bights have been taken, as shown in figure 140, and a proper length of 16 to 18 inches of line is left between the last bight and the skirt hem, check for dropped lines by holding the two groups of lines free of the table and observing the sag. If excessive sagging is evident, the lines must be pulled out to the point where the lines have been dropped; and reassembled.

Figure 141 illustrates evidence of "dropped" lines.

The hesitator loops are straightened, as shown in figure 142. Place the lift web protector flaps over the lift webs and turn the container one-fourth turn in a clockwise direction,

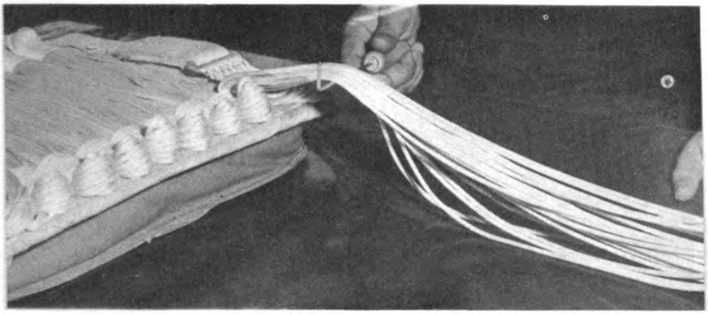


Figure 141. —Illustrated evidence of "dropped" lines.

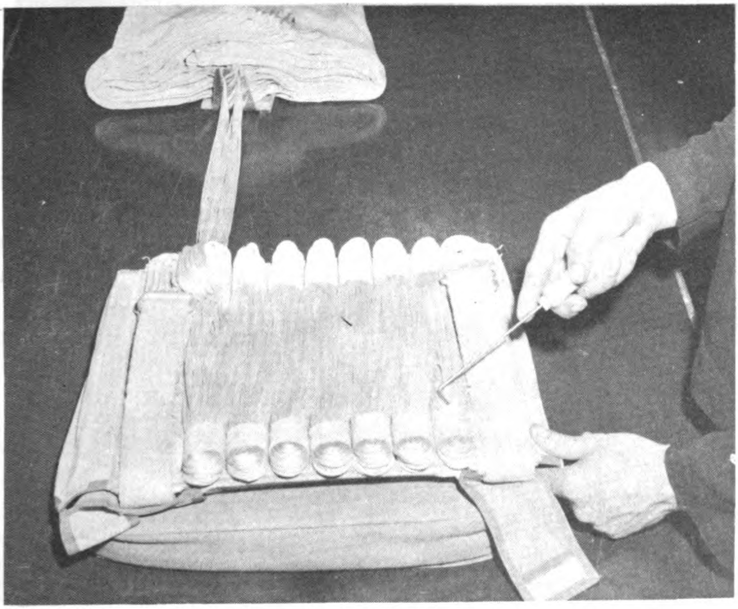


Figure 142. — Straightening hesitator loops.

The container is now ready to receive the canopy. The packer removes the first shot bag and grasps the canopy in the vicinity of the skirt, taking care not to disarrange the folds, and brings the skirt up flush with the rip cord end of the container. This step is illustrated in figure 143. At the same time,

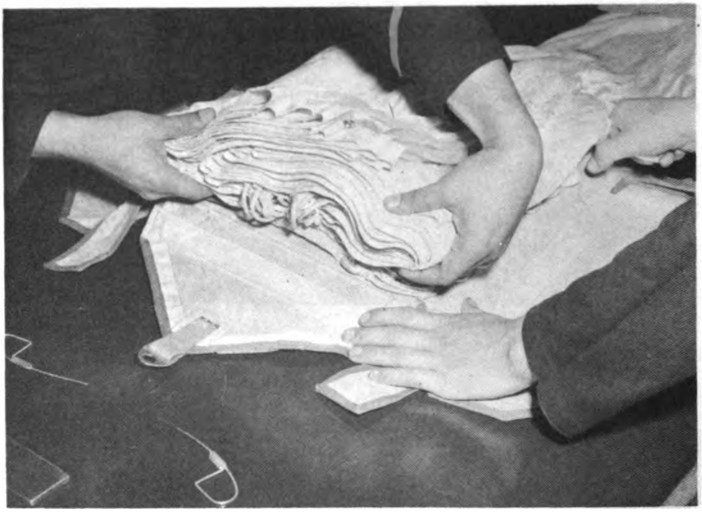


Figure 143. — Stowing the canopy.

the helper inserts the long bar across the pack and holds back on the shroud lines to prevent their disarrangement.

In bringing up the next fold, the helper places his long bar parallel with the opposite end of the container while holding

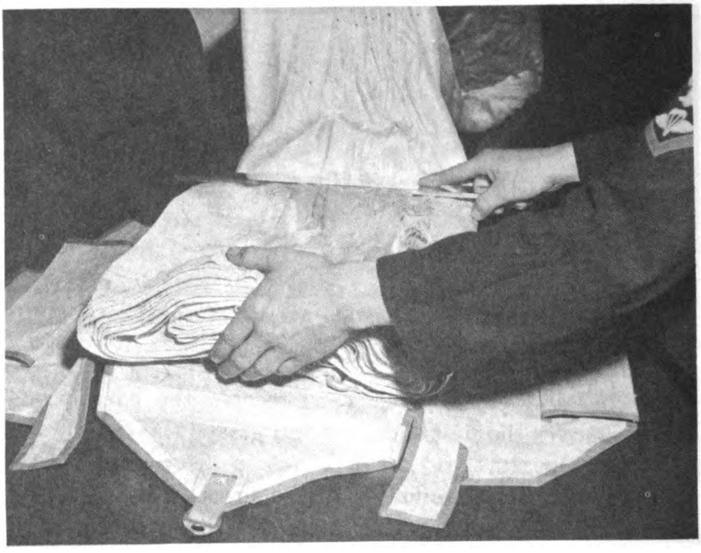


Figure 144. — Bringing second fold into position.

the skirt in place with his left hand, as shown in figure 144. The packer makes certain that the long bar is in proper position along the edge, paying particular attention to the corners.

The second fold, shown being brought into position in figure 144, comes to rest just aft the skirt hem, as shown in figure 145. Bringing the fold up even with the skirt hem would create too much bulk. The fold illustrated levels off the added bulk of the hem, making a flat surface for the remaining folds.

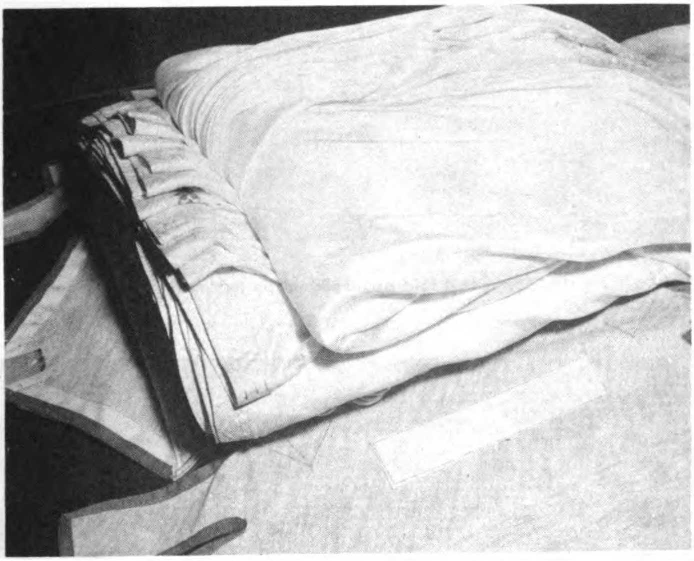


Figure 145. — Final position of the second fold.

Remember that each fold is drawn out to the edges of the container and that particular attention is paid to the corners. If the corners are not filled out, they will be soft and will fail to hold the corner flaps inserted later. Resultantly, the canopy fabric will protrude from the corners to become damaged and soiled.

The last fold is made by tucking the peak under as shown in figure 146. Notice that the peak is turned DOWN, thus eliminating the possibility of the pilot-chute frame later catching in the peak-opening and "hanging up."

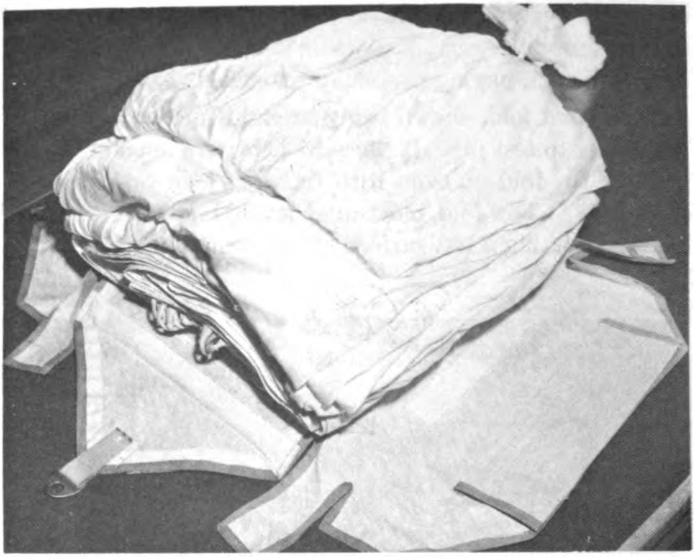


Figure 146. — Last fold accomplished by turning the peak under.

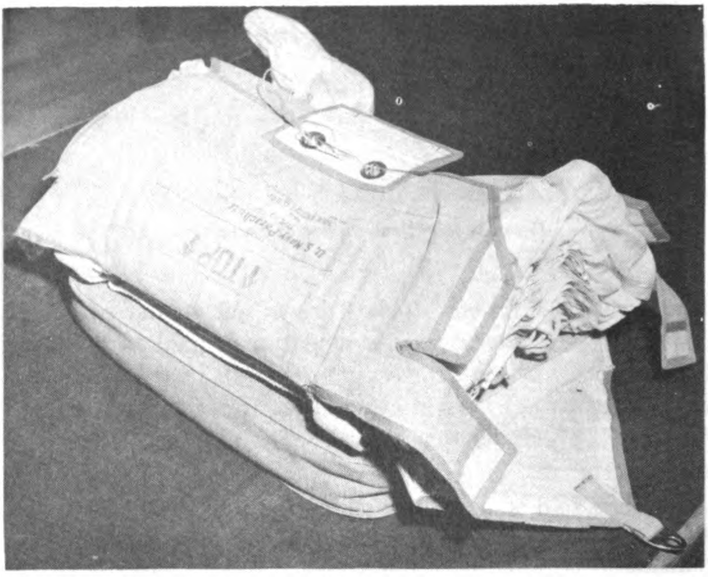


Figure 147. — Temporary locking pins holding side flaps.

Turn the container another one-quarter clockwise turn when the side flaps are brought up and the temporary locking pins inserted, as shown in figure 147. The side flaps are brought up together by tugging on the pilot-chute protector flaps. The pilot-chute protector flap on the cone side is placed beneath the other flap, and both are held as the cone side is set in position. The grommet side is then placed over the cones and the pins inserted through holes in the cones to temporarily hold the container closed. See that no wrinkles are present in the protector flap.

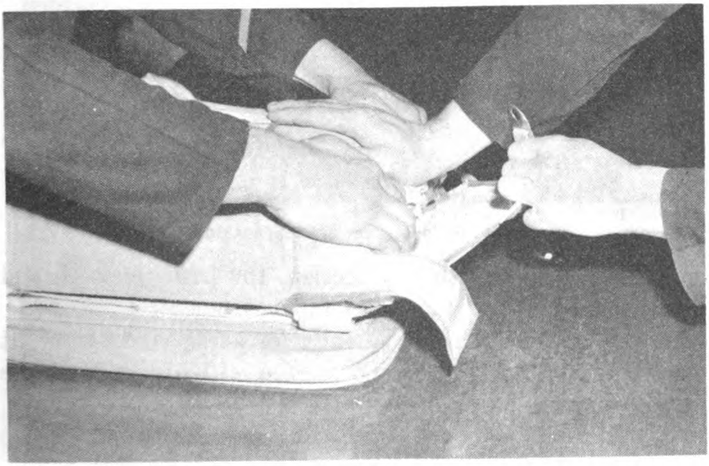


Figure 148. — Closing the first end.

Straighten the canopy protruding from each end, making sure that the corners are filled and that the end folds are evenly stacked. The helper now brings up the rip cord end of the container as the packer holds the side flaps snugly in toward the silk, as may be seen in figure 148.

The end tab is placed over the respective cone as the temporary pin is removed. This pin may be re-inserted, or the respective locking pin of the rip cord assembly inserted, whichever is desired. In figure 149, three sides of the container are closed and held in place by temporary pins.

As the helper holds the pilot-chute connector cord, the packer unsecures the pilot chute and examines it for spring action and

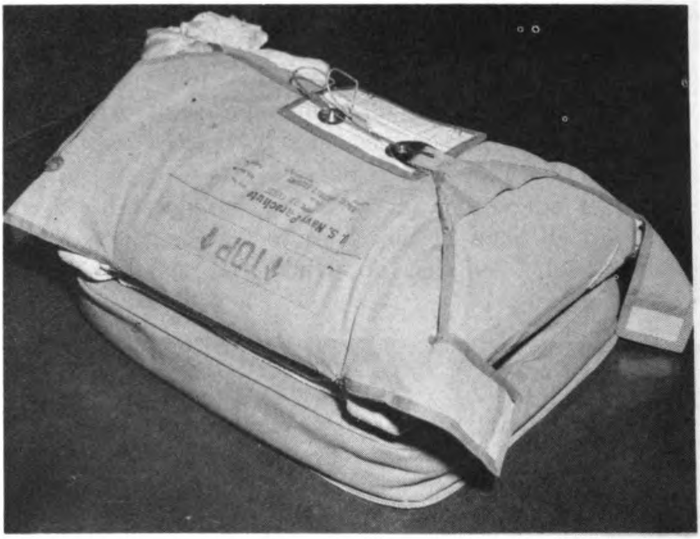


Figure 149. — Three sides of container closed.

other factors. During this inspection, the pilot-chute shroud lines are evened and all tangles eliminated.

Close the frame so that it is ready for action and bring out the skirt of the pilot-chute canopy even with the ends of the

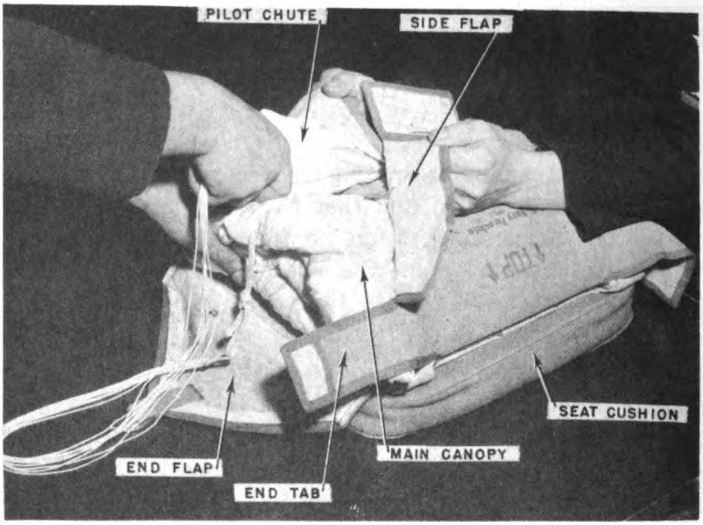


Figure 150. — Insertion of pilot chute.

ribs of the frame. Carefully blossom out the folds caused by the frame closing. Never tuck the skirt toward the center of the pilot chute, or the shrouds will naturally follow and create the possibility of a foul.

Figure 150 shows the pilot chute being inserted between the top pilot-chute protector flap and the side flaps of the container.

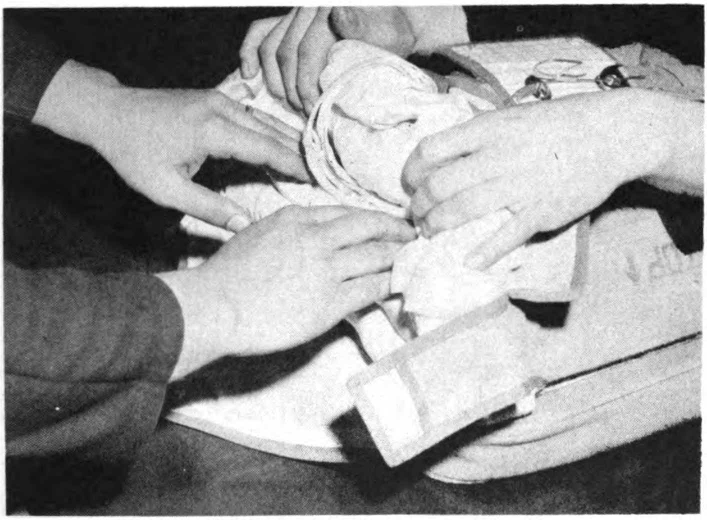


Figure 151. — Stowing pilot-chute shrouds.

Stow the pilot-chute shroud lines between the first or second top folds of the main canopy, as pictured in figure 151. When placing the lines between the folds, set the lines "in" barely enough to avoid possibility of disturbance by the closing of the container.

While the helper holds the side flaps, the packer brings the end flap up and places the end tab over the respective cone. At the same time, the temporary pin is withdrawn and re-inserted.

The long bar is now used to straighten the end of the pack. Using a fid, the ends of the side flaps are gently worked into place under the end flaps, after which the fids are inserted between the lift webs and protector flaps until they reach the small pockets in the ends.

With the fid, as shown in figure 152, push inward toward the center of the end to tighten the corner and make it ready for the corner flaps shown in the illustration. Then carefully insert each of the four corner flaps, placing the fid in the pocket located in each flap. The flap is directed to the end of the pack and slowly entered without wrinkling.

Flaps must be kept free of wrinkles — a wrinkled piece of cloth will soon tear. The forefinger held as shown in figure 153 will aid in preventing such mishap.

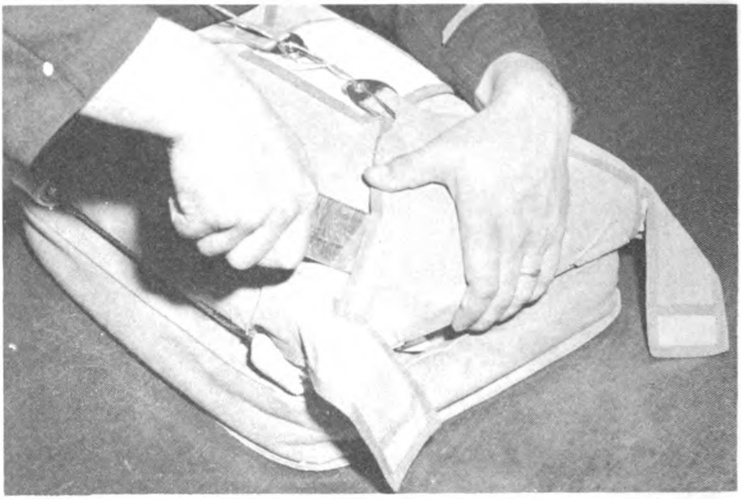


Figure 152. — Final straightening of the end flaps.

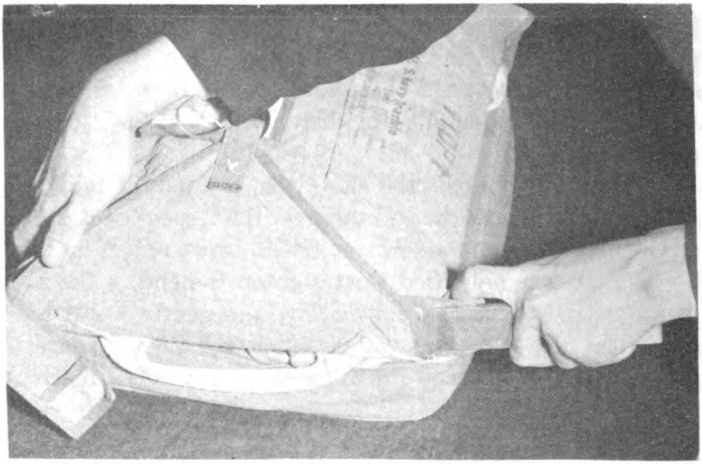


Figure 153. — Guiding the corner flaps to prevent wrinkles.

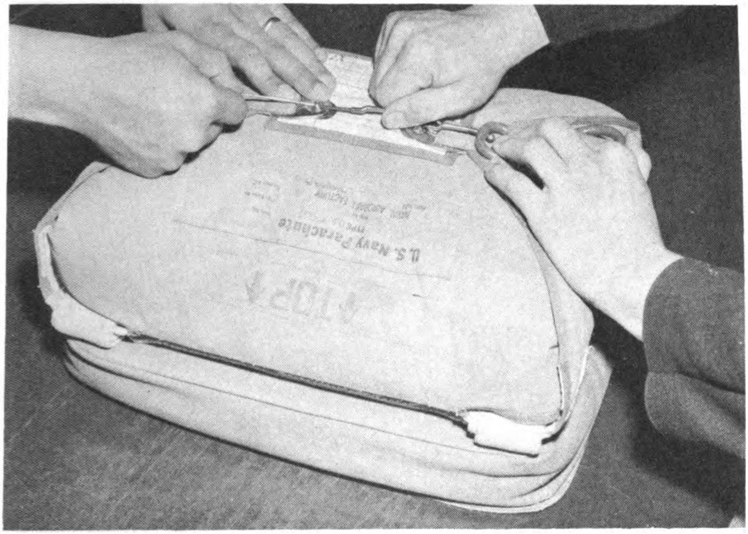


Figure 154. — Inserting the rip cord.

When all corners have been neatly tucked in place with no silk showing, check your tools to see that none has been left in the pack.

Carefully remove the temporary locking pins and insert the rip cord assembly as shown in figure 154. Insertion of the rip cord at this point is a comparatively simple step, since the pack has been smoothed out and offers less resistance than if the cord had been previously inserted.

Break off a 10- or 12-inch length of 24 x 4 thread used for SAFETY TYING the rip cord, and slip the thread beneath the pin as demonstrated in figure 155. Equalize the length and pass at least three half-hitches about the cable, cutting the thread close to the cable.

The SAFETY TIE of 4.5 pounds tensile strength holds the rip cord in place in the locking cone holes. The force of the pack itself is sufficient to hold the rip cord, but the additional safety tie tends to prevent, to a certain extent, a premature opening. The force necessary to crack the chute should not exceed 22 pounds. If 24 x 4 cotton thread is not available for the safety tie, a thread with from three to five pounds tensile strength may be used.

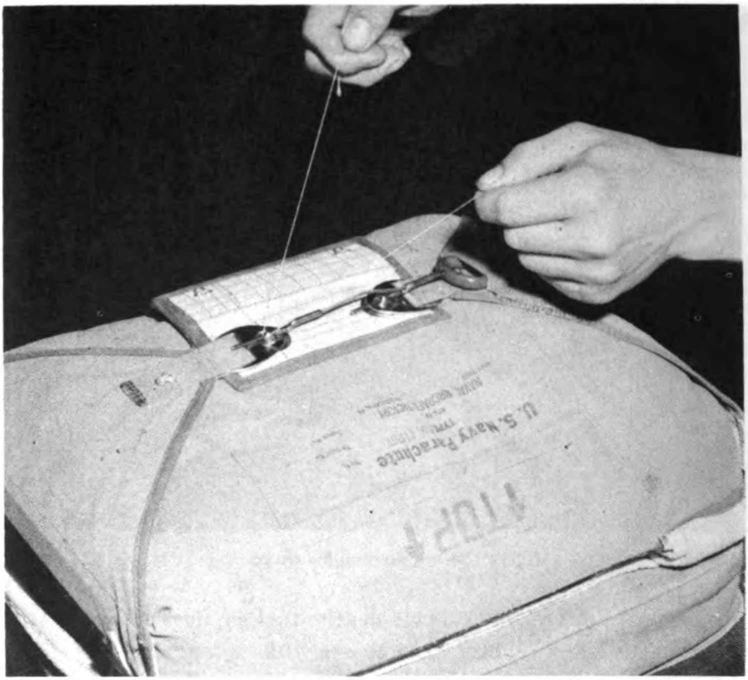


Figure 155. — Safety tying the rip cord.

Hook up the pack-opening elastics as illustrated in figure 156, making certain the elastics are running free and are secured at both ends. As each elastic is hooked up, pull each well beyond the edges of the pack to equalize elasticity of the inner rubber strands.

Carefully inspect the pack, and if all is in order, enter the proper data on the PACKING DATA CARD.

The next step is to examine the QAC harness. Inspect the webbing for chaffed places and for signs of failure. All points of webbing termination — such as in the back- and leg-straps — should be sewn down according to pattern. Hook snaps must work freely, and the tongue should snap back with a positive action. No evidence of rusted hardware should be apparent. See that quick-connector links are tacked in the proper upward angle, and check the back-pad for missing or improperly functioning keepers and for cleanliness. This accomplished, you are

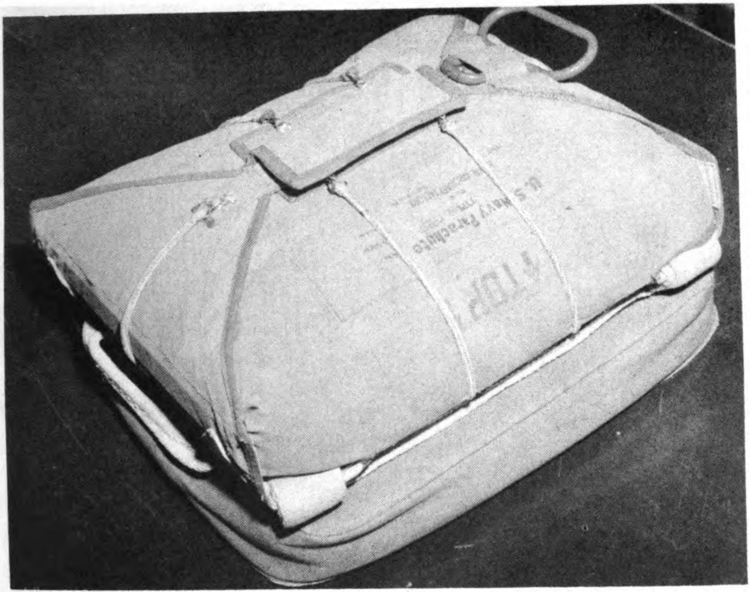


Figure 156. — Pack-opening elastics secured.

ready for the adjustment and tacking of the harness to the back-pad.

Figure 157 illustrated the tacking points for holding the QAC harness in place on the back-pad.

These tackings should be made only when the harness is adjusted to an individual, and that person is expected to retain that particular harness.

QAC — 24-FOOT CANOPY WITH RAFT AND WITH REGULAR HARNESS

The assembly of the pararaft kit to the QAC parachute has been improved, first, to withstand the greater stresses imposed on the assembly when wearers make exits from planes traveling at moderately high speeds, and, secondly, to assure that the pararaft kit alone may be readily available and easily separated from the parachute pack.

Packing procedure remains the same as previously described for the QAC without the pararaft. The differences in rigging technique will be discussed later.

If the QAC has been previously packed and rigged WITHOUT

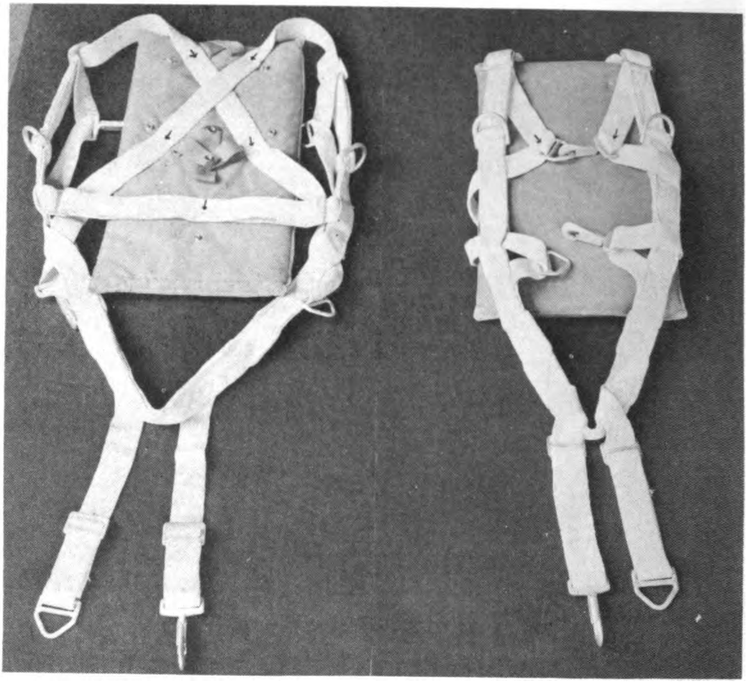


Figure 157. — QAC harness tacking.

the raft attachment, consult the following steps and illustrations for rigging procedure of the parachute WITH the raft.

Lay out the parachute, pararaft, and raft container on the packing table. Insert the pararaft kit or case in the raft container and secure it by means of the fastening device, as shown in figure 158.

Take up the slack by snugly adjusting the cross strap. The container is designed to accommodate pararaft kits of slightly different sizes due to repacking, etc.

Make a tacking, using 30 x 3 or 6 cord, to hold the adjustment in place, then adjust the center parallel strap so that the quick-release snap and "V" ring hold snugly. It will be necessary to remove the raft while completing these steps. Replace the raft in the container and check the fit and operation of the quick-release snap.

Cut the lift web tackings and re-position the lift webs by matching the pack and raft so that the quick-connector snaps may be tied to the raft container, as illustrated in figure 159. This brings a considerable length of the lift web from the pack.

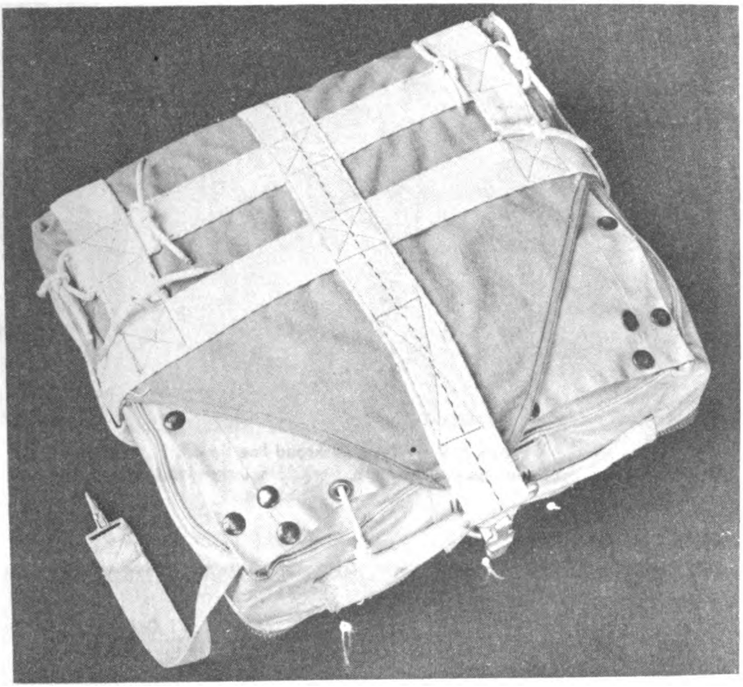


Figure 158. — Raft held in container by quick-release snap.

When the proper length of lift webs has been determined, mark the lift webs at the point of entry to the parachute pack so that when the raft is removed, the lift webs will be tacked in proper positions.

Set aside the pararaft and container, and tack the lift webs to the pack as indicated in figure 160.

Remove the raft from the container and tack the container to the parachute pack at the six points shown in figure 161, using 9-cord doubled and waxed, first having ascertained that the pack-opening elastics are properly secured and running free.

Slip the raft back into the container and make the six safety-strap tackings indicated in figure 162, using 30 x 3 thread.

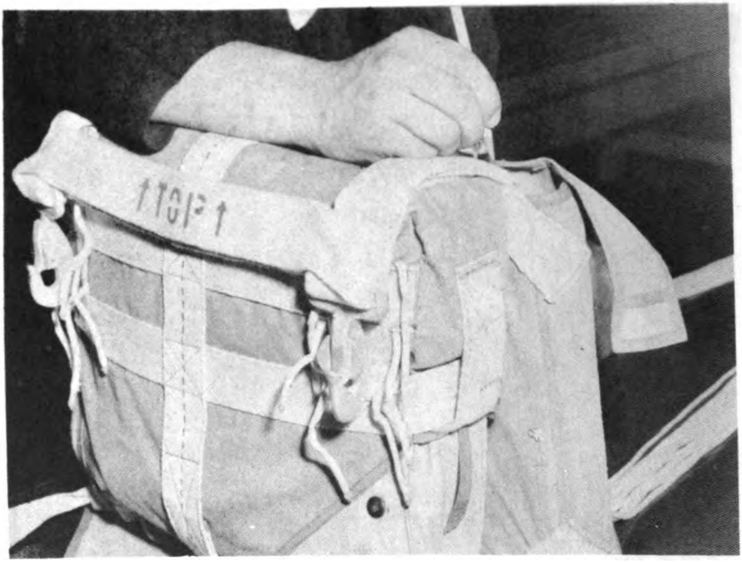


Figure 159. — Type III shroud-line tie off.
Three ties to each snap, each 11½ inches long.

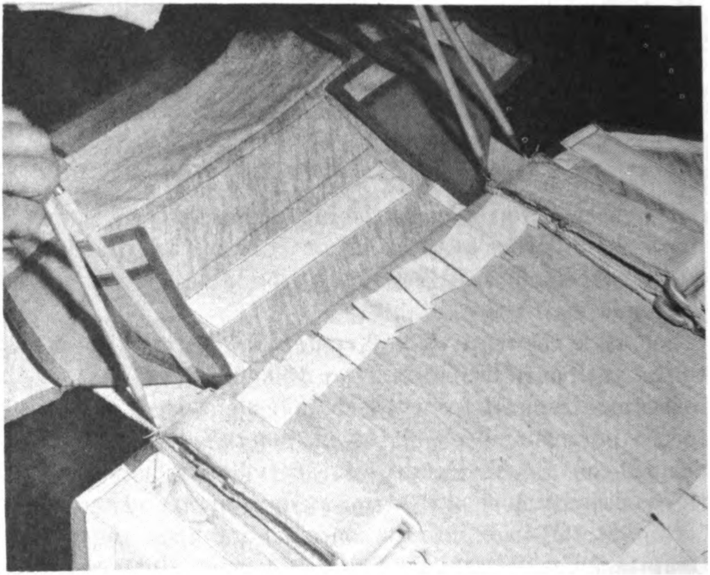


Figure 160. — Lift webs tacked in four places, as indicated by pencils, with 30 x 3 thread doubled and waxed.

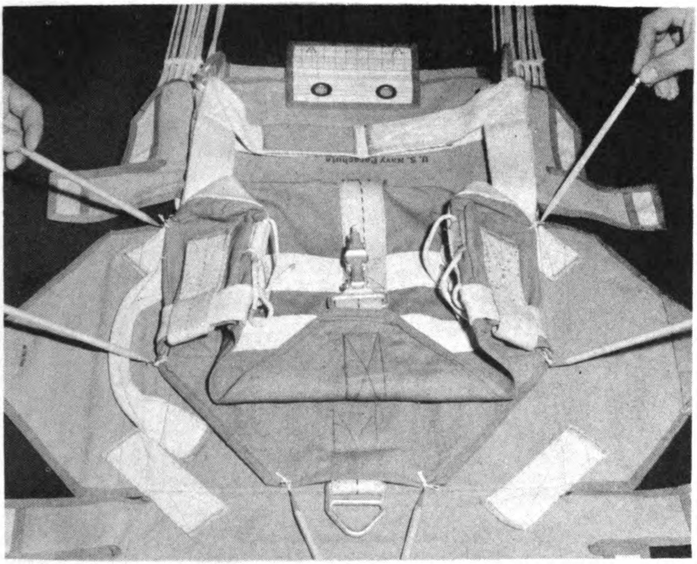


Figure 161. — Raft container tacked at six points to parachute pack.

Tie off all tackings with a surgeon's knot and overhand knot, leaving between one-fourth and one-half inch of bitter end. Draw all tackings firmly to prevent shifting, and tie the quick-connector snaps in place as shown in figure 163.

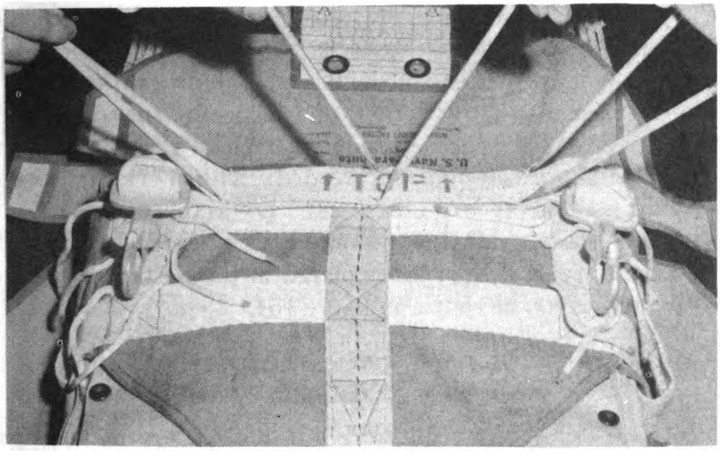


Figure 162. — Pararaft safety-strap tacking.

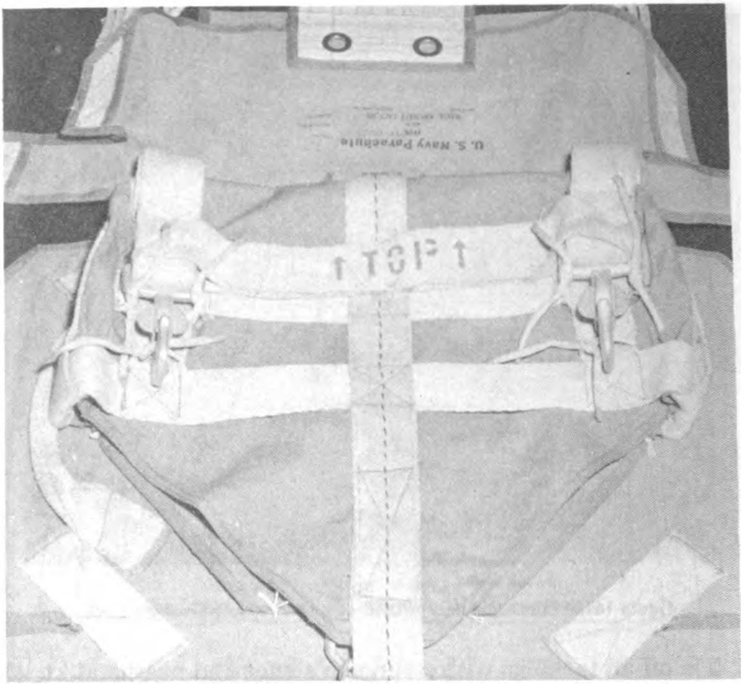


Figure 163. — Quick-connector snaps tied in place.

The raft may now be either removed or left in place while the parachute is packed as previously described. Use a cushion when packing.

Make certain that enough RAFT RETAINER WEBBING is out of the raft case at a lower corner, and secure by snapping to the fastener provided at that corner. Attach to the raft retaining webbing snap a shipping tag worded: "FOR WATER LANDINGS, SECURE THIS SNAP TO LIFE VEST 'D' RING, KEEPING RAFT RETAINING LINE FORWARD OF PARACHUTE HARNESS MAIN SLING."

When the raft case or kit is placed in the container, the side of the raft is UP, as shown in figure 164.

QAC — 28-FOOT CANOPY WITHOUT RAFT AND WITH OVERSIZE HARNESS

The greater length of the 28-foot canopy is for the most part gained in the top "D" section, which measures 45¾ inches,

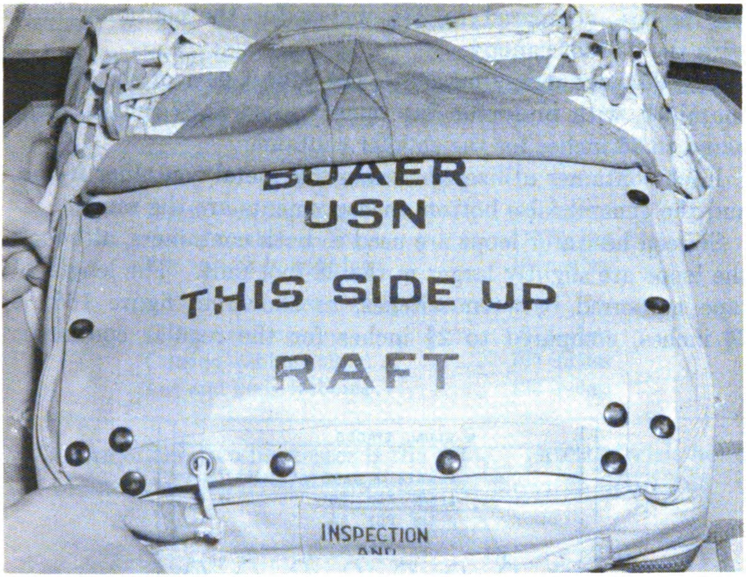


Figure 164. — "This side up."

compared to the $17\frac{15}{16}$-inch "D" section of the 24-foot canopy.

The total shroud line length of the 28-foot canopy, measured along a radial seam from skirt edge to suspension-line peak, is 168 inches, compared to 144 inches in the 24-foot canopy. The shroud line length of the 28-foot canopy, from skirt edge to the link, is 22 feet $10\frac{1}{2}$ inches, compared to 20 feet in the 24-foot unit.

The 28-foot canopy has a total of 14 continuous shroud lines, each terminating in four links with seven lines attached to each link. The 24-foot canopy has a total of 12 continuous shroud lines, each terminating in four links with six lines attached to each link.

The 28-foot canopy is made up of four sections to a gore, with 28 gores to a canopy. The 24-foot canopy has four sections to a gore and 24 gores to a canopy.

Both canopies have 18-inch diameter vents.

The parachute container used with the 28-foot canopy, measured from center line of the end tab hole on one end to the center line of the end tab hole on the opposite end, totals

35¼ inches, compared to 33¼ inches for the container used with the 24-foot canopy.

The distance measured across the widest part of the 28-foot container, with protector flap open, measures 37 inches, compared to 35 inches for the smaller container.

Each container utilizes the same size metal container frame, and the general false bottom measurements are the same.

Sixteen hesitator loops are used in both containers, although the loops are slightly larger in the 28-foot unit. The length of tape measured between stitches, as shown in figure 165, is 2⅝ inches, compared to 2⅜ inches for the regular container.

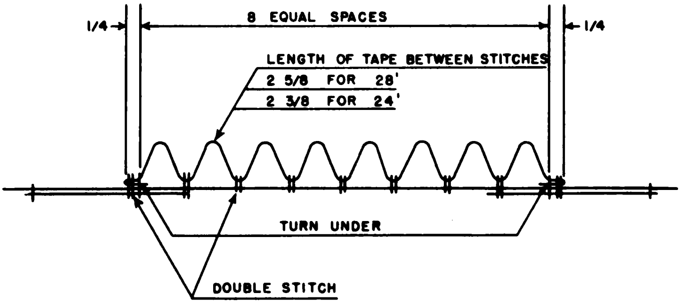


Figure 165. — Inter-stitch measurement between loops.

The increase of one-fourth inch in the 28-foot container may be attributed to the fact that 28 shroud lines must be drawn through each loop, compared with 24 lines in the regular-size container.

The 28-foot container gains its size due to the end and side flaps being larger than those of the regular container.

OVERSIZE HARNESS VS. REGULAR SIZE HARNESS

The oversize harness is designed for use with the 28-foot canopy, and the combination furnishes large men with a comfortable fit and a comparatively safe rate of descent. Differences in the oversize and regular harnesses used with the 24-foot canopy may be summarized as follows:

The distance measured from the center line of the main sling to the center line of the quick-connector link, for the oversize harness, is 27½ inches compared to a measurement of 24½ inches for the regular harness.

The major remaining differences between the two harnesses are in the webbing lengths:

OVERSIZE HARNESS	
Inside webbing sling	79 inches
Outside webbing sling	119 inches
Leg and body webbing	129 inches
REGULAR HARNESS	
Inside webbing sling	67 inches
Outside webbing sling	107 inches
Leg and body webbing	123 inches

Design of the two harnesses is the same. Latest models have the main sling *split* at the center line, as shown in figure 166.

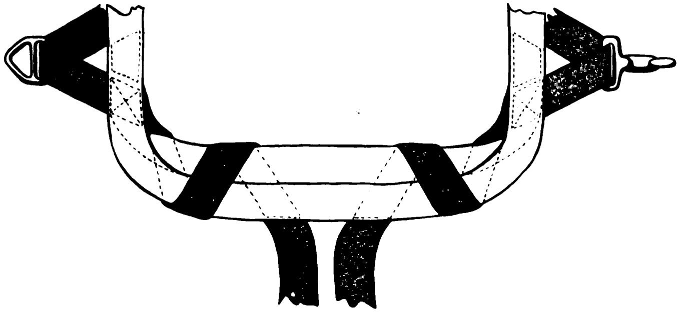


Figure 166. — Main sling split at center line for added support.

When packing the QAC and the 28-foot canopy, make certain that the proper parachute container is used.

No difference exists in the adjustment of the oversize harness. Treat it in the same way as the regular harness.

QAC — 28-FOOT CANOPY WITH RAFT AND WITH OVERSIZE HARNESS

Either size canopy may be used with the quick-fit harness, since the unit is made in one size only and may be adjusted to varying requirements.

No change need be made in the packing and rigging procedures from those previously outlined. In changing from a 24- to a 28-foot canopy, the lift web assembly is assumed already attached.

Inspect the QAC quick-fit harness for signs of chafing, especially in areas where friction adapters and snaps are located. Check the tabs sewn in the ends of webbing located in chest and leg straps, and check all hardware for free and positive action.

Since this harness must remain adjustable at all times, temporary tacking to the parachute harness or back-pad, which will hamper adjustment, must not be used. The only permissible tacking is that on the chest strap, which may be tacked about six inches below the fixed shoulder adapters, for adjustment accommodating all sizes of personnel.

QAC — 24- OR 28-FOOT CANOPY WITH RAFT AND WITH QUICK-FIT HARNESS

No differences exist in rigging techniques between the 24- and 28-foot canopies, and with the quick-fit harness, than have been previously described.

SS — 24-FOOT CANOPY WITHOUT RAFT AND WITH REGULAR HARNESS

The SS parachute is packed similarly to the QAC — up to a certain point — although there are considerable variations in rigging due to the fact that the seat-type chute is a "fixed" design.

In the description of packing and rigging procedures to follow, we will consider the parachute as completely unassembled, and explain in a step-by-step process the best methods of putting the unit in a first-class working condition.

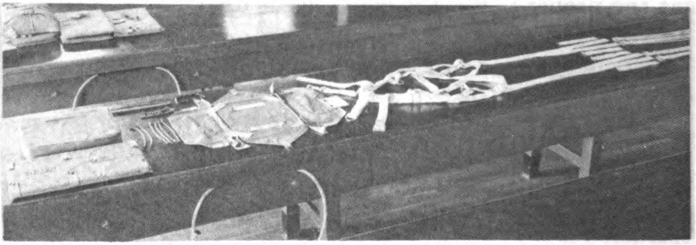


Figure 167. — Unassembled seat-type parachute.

Figure 167, illustrating an unassembled seat-type parachute, shows the various parts of a seat-type chute in relative positions. Notice that the harness is not secured to the canopy which, in this instance, is a 24-foot design.

Clear the table of all assemblies except the harness and canopy, and hook up the canopy under tension. Check shroud lines for tangles, removing any fouls at the links.

When the proper rotation of the shroud line has been ascertained, with the top gore of the canopy in the *up* position, proceed with the inspection. Make certain that the canopy and harness are in perfect condition before securing the lift webs to the links. The steps in the process are shown in figure 168.

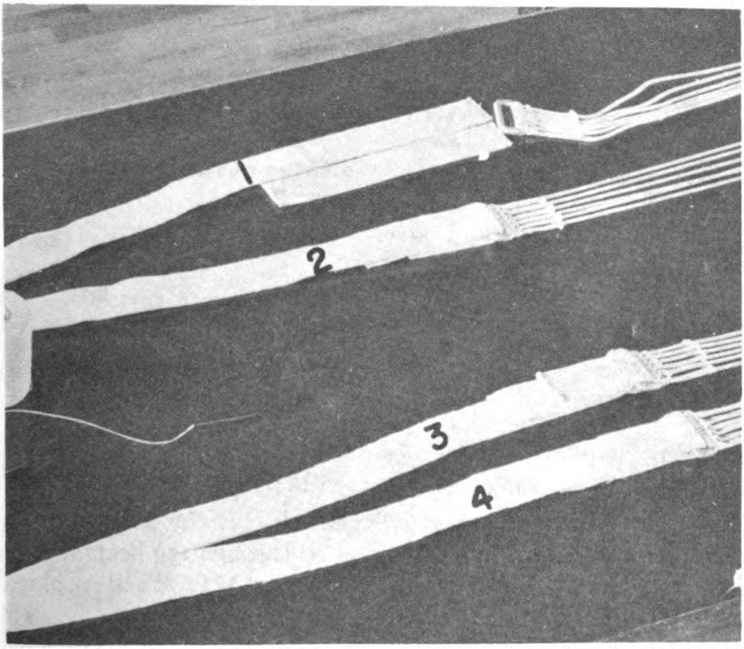
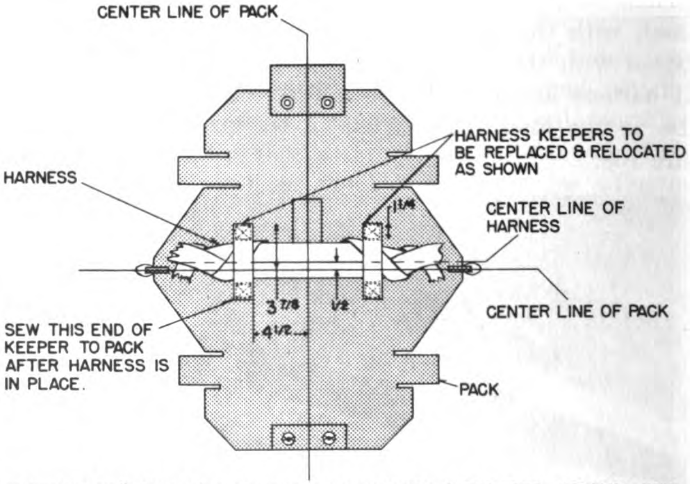


Figure 168. — Steps in securing lift webs to links.

After the harness has been attached to the links by its lift webs, recheck the shroud line rotation and secure the proper container for assembly at the main sling of the harness.

The latest canopies are made with 20-foot shrouds, measured from links to skirt. A container with 14 to 16 hesitator loops is consequently necessary for use with this length of canopy.

When a split sling, or a regular sling with raft-retaining straps, is incorporated, it is important that the PACK KEEPERS be of proper length to accommodate such arrangement. This point is illustrated in figure 169.


CENTER LINE OF PACK
HARNESS KEEPERS TO BE REPLACED & RELOCATED AS SHOWN
HARNESS
1 1/4
CENTER LINE OF HARNESS
CENTER LINE OF PACK
3 7/8
1/2
4 1/2
SEW THIS END OF KEEPER TO PACK AFTER HARNESS IS IN PLACE.
PACK

WEBBING 6 3/4" LONG SPEC. AN-W-21 TY VI COTTON-2 REQUIRED. COTTON SEWING THREAD 16-4 CORD SPEC. V-T-276 TYPE IB 3, AIRCRAFT GRAY

Figure 169. — Seat pack with longer keepers for use with split-sling harness.

When the pack has been positioned, as figure 170 illustrates, make box "X" sewings, as indicated in figure 169.

As this parachute is being rigged without the pararaft, the PARARAFT RETAINING WEBS are passed through the keepers and under the main sling, as detailed in figure 171. Tack in place with No. 30 x 3 or other suitable thread.

Tack the main sling to the keepers as shown in figure 172, with two turns of 6-cord, single, on four outboard corners, to prevent the pack from slipping.

Attach the pack-opening elastics, then tack the seat cushion to the pack with two turns of 6-cord doubled and waxed, passing the tacking around the pack frame at all four corners and

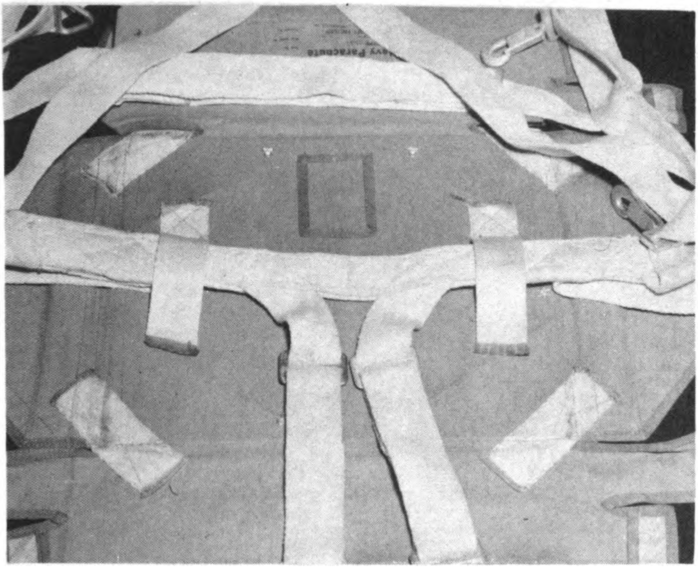


Figure 170. — Seat pack positioned ready for attachment of keepers.

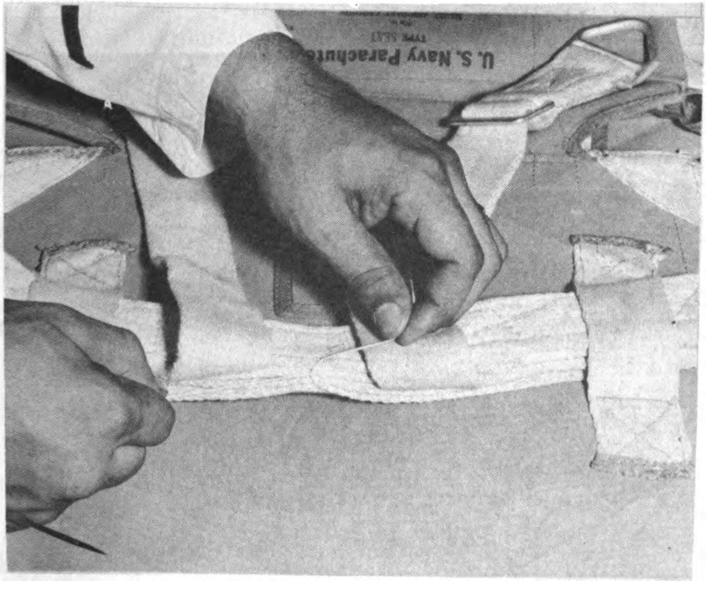


Figure 171. — Pararaft retaining straps tacked under the main sling.

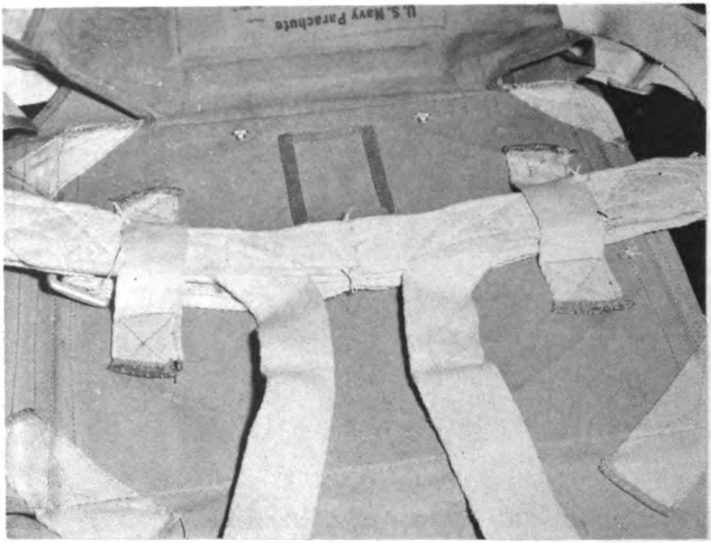


Figure 172. — Main sling tacked to keepers.

securing with a surgeon's and a square knot. Tack the rip cord housing, 24¼ inches in length, to the pack-end flap, the location of which is shown in figure 173.

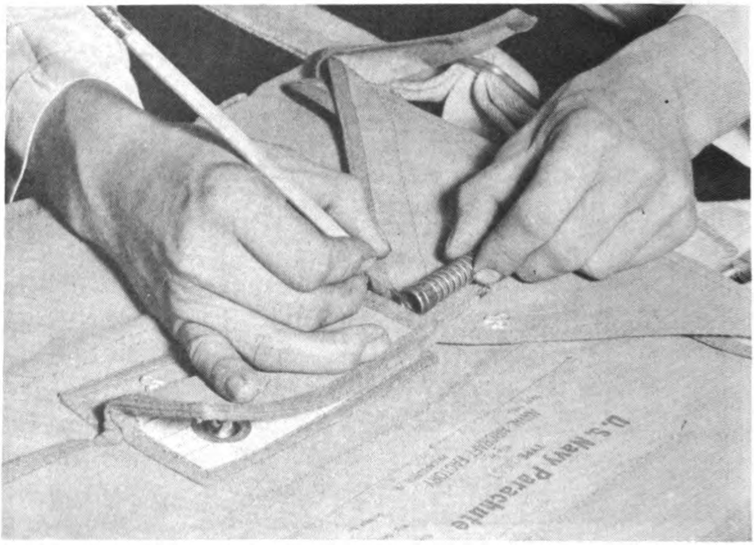


Figure 173. — Point of attachment of rip-cord housing to pack end-flap.

Figure 174 shows the method of tacking the latest type rip cord housing to the pack. Run the needle close to the hardware and draw each completed turn taut. using 6- or 9-cord, single, and waxed.

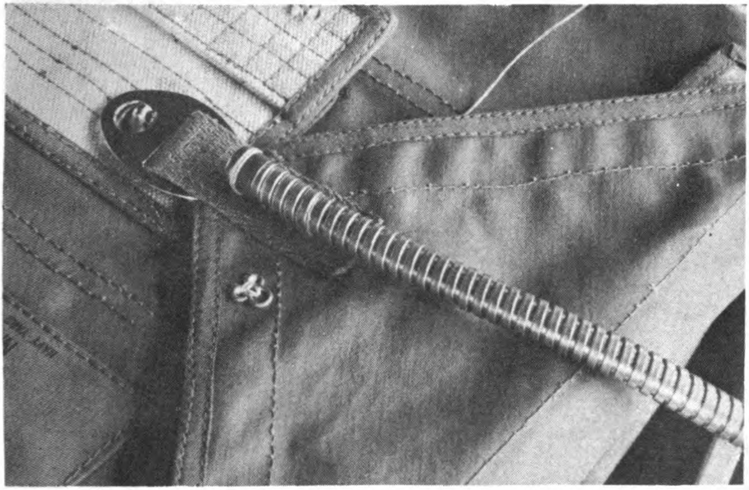


Figure 174. — Top view of housing tacking.

Before beginning the tacking, tie a knot about six inches from the end of the cord to prevent it from pulling through on the first turn. The "tail end" of the cord is then held down on the inside, each subsequent turn passing over to hold it in place, as shown in figure 175. Notice in this illustration that the tacking is started from the inside and passed over and around the groove near the mouth of the ferrule.

Tie off ON THE INSIDE with a surgeon's knot and a square knot, making certain no side play exists in the housing. This tacking, shown in figure 176, must be secure.

Do not attempt further housing tacking until after the parachute has been packed. The reason for this will be explained later.

Hook up the peak of the canopy, straighten the harness, and check again for fouls before tacking the lift webs to the pack.

Eliminate lost motion. In straightening the harness, begin at the main sling center line, between the leg straps. Alternately work up one side and then the other, cleating all twists

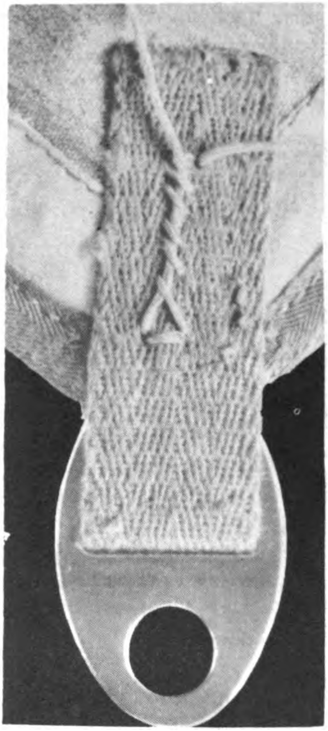


Figure 175. — Underside view of tacking.

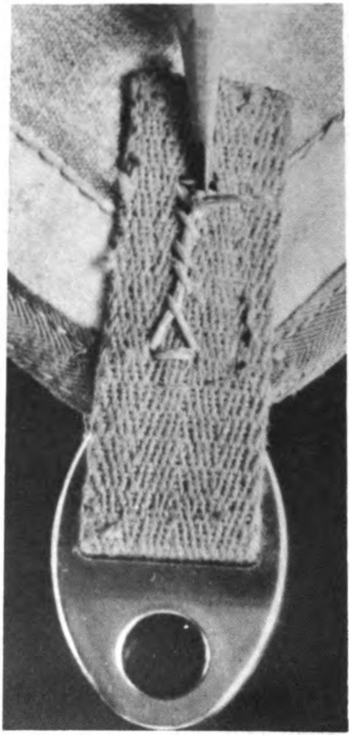


Figure 176. — Tacking completed and tied off.

and turns. Make certain that the chest strap is in position in the front of the harness, and check the passage of the back- and cross-shoulder straps.

At this point, the back-pad may be snapped in position to aid in holding the harness webbing in a relatively secure position. When the harness is straight and the continuity of the shrouds has been assured, tack the lift webs in the pack as described in figure 177.

The seat-type parachute is shown "hooked up" and ready for packing in figure 178.

The next step consists of packing the parachute. In passing the rip cord assembly through the housing and the pins into the cones, make certain that the pins are properly seated and

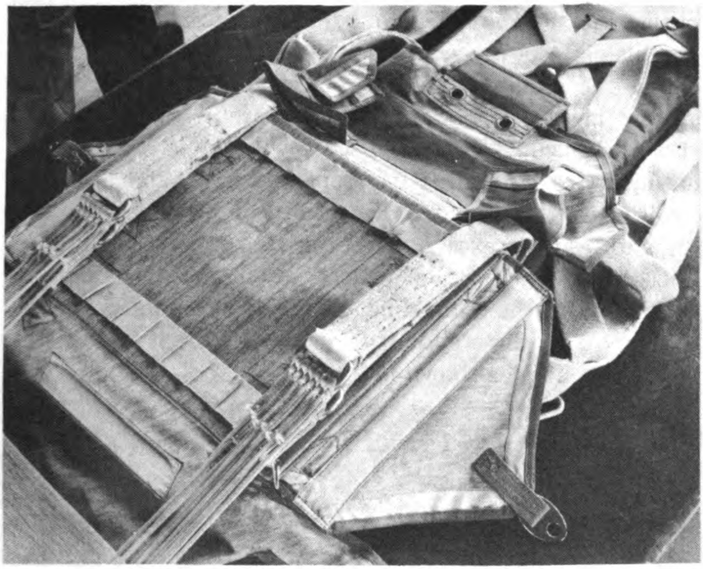


Figure 177. — SS lift-web and pack tacking.

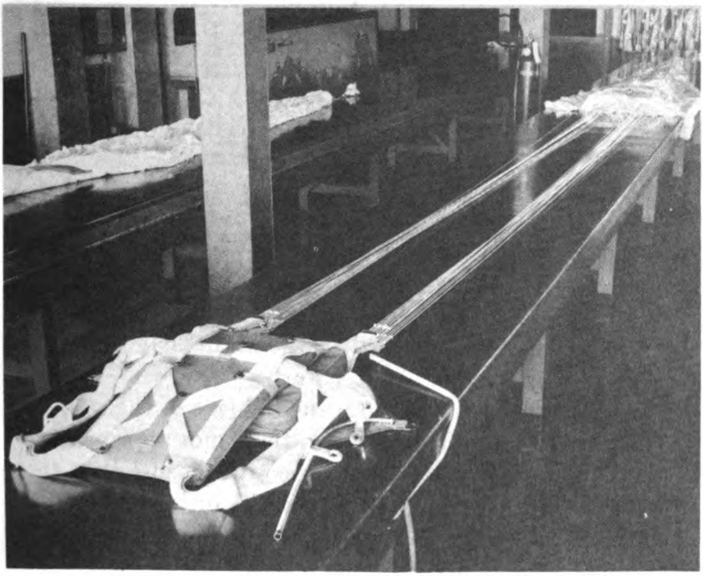


Figure 178. — SS chute ready for packing.

completely inserted. This operation is best accomplished after all housing tackings have been made, as the absence of the rip cord at this point of procedure makes for easier handling.

Tacking the remainder of the housing in place and hand-sewing the hand-pull pocket requires careful judgment and expert workmansnip. Too much slack will shorten the housing, preventing it from reaching its proper position, and too little slack will cause the weight of the pack to be absorbed by the housing and result in excessive wear or rupture.

Pass the free end of the housing around and behind the TRAILING EDGE of the main sling, then under, emerging on the LEADING EDGE of the webbing to a point slightly above the back-strap opening, as shown in figure 179.

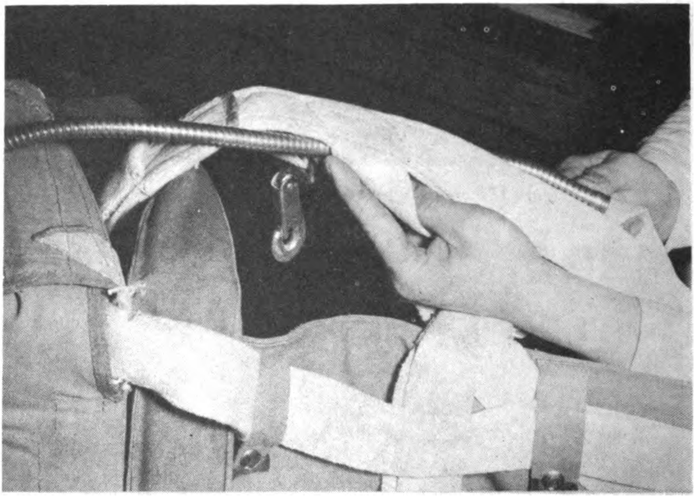


Figure 179. — SS parachute housing passage.

The rip cord housing is tacked to the harness at two points as illustrated in figure 180.

"Inside tacking" is made first on the flat side of the webbing, as shown in figure 180. Remember to tie a knot approximately six inches from the end of the tacking cord to insure that there is enough left over for tying-off. Hold the bitter end in place against the housing as each turn is made around the housing and through the webbing, and tie off with both bitter ends, using a surgeon's knot and a square knot.

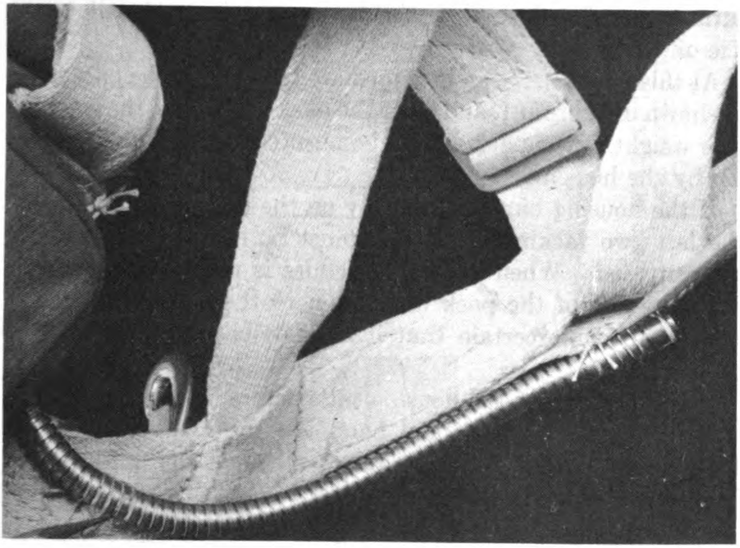


Figure 180. — Attachment of rip cord housing to harness.

"Top tacking" is next made, and is described in figure 180. Hold the bitter end in place along the webbing edge as each

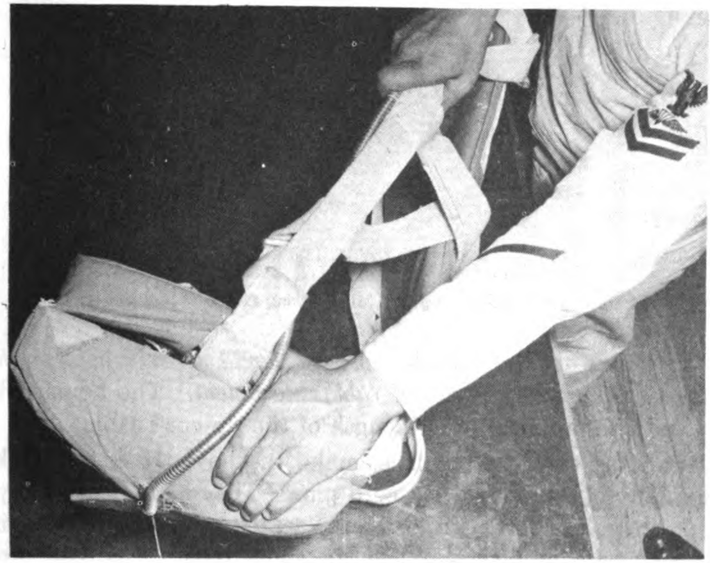


Figure 181. — Checking housing for slack.

turn is completed so that the bitter end is inside all turns. Tie off as usual.

At this point, make an intermediate test. Hold the parachute as shown in figure 181, and force the pack away from the harness. The weight of the pack should be absorbed by the harness and *not* by the housing.

If the housing binds excessively on the end flap of the pack, the last two tackings fashioned must be cut and the housing re-positioned. When such a procedure is required, first check the centering of the pack in relation to the center line of the harness to make certain that it has not been tacked in place off-center.

If the test proves the housing satisfactory, enter the rip cord and proceed to position and hand-sew the hand-pull pocket. Figure 182 illustrates and provides all necessary information for accomplishment of this step.

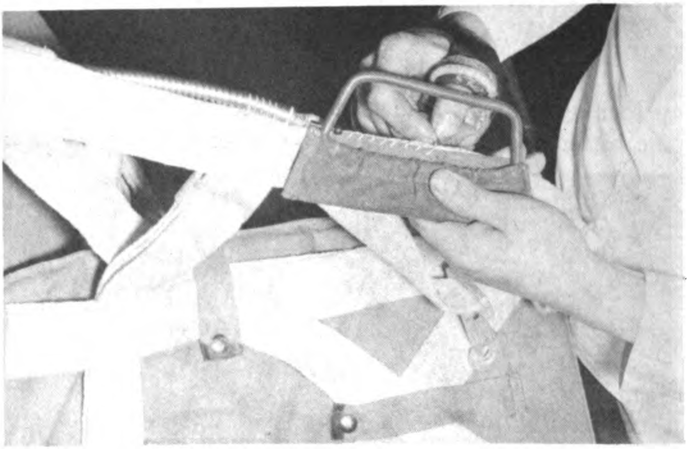
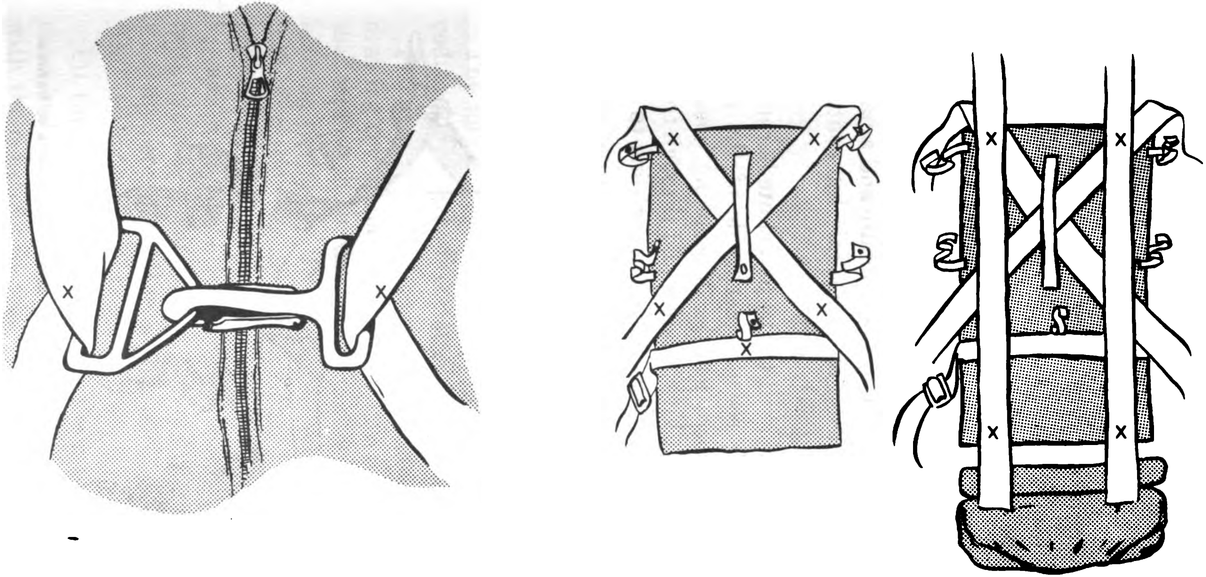


Figure 182. — Positioning and hand-sewing the hand-pull pocket.

An undue amount of cable exposure should not exist between the housing mouths and points of cable attachment. The housing is designed to protect the full length of the rip-cord cable.

With the rip cord in place, make the final check for slack, especially observing the rip-cord pins. They have been safety-tied, and should remain perfectly seated and undisturbed in the locking-cone holes. When the chute passes this test, pro-



TACKED WITH 6 CORD SINGLE AND WAXED
2 TURNS

TACKED WITH 6 CORD
SINGLE AND WAXED 1 TURN

TACKED WITH 30X3 THREAD
DOUBLED AND WAXED 1 TURN

Figure 183. — Methods of tacking SS harness, front and back.

ceed with the rigging by checking the hand-pull in its pocket, where it should fit snugly, facing outward. Removal of the hand-pull from its pocket must be smooth and positive. **NEVER TACK THE HAND-PULL IN ITS POCKET.**

When the parachute can be adjusted to the individual wearer, refer to figure 183 for methods of tacking the harness.

SS — 24-FOOT CANOPY WITH RAFT AND WITH REGULAR HARNESS

The combination seat-type parachute and pararaft kit consists of a Navy standard seat-type parachute and a pararaft kit attached together by means of a pararaft kit container and two pararaft kit retaining webs or straps.

The pararaft kit is attached to the parachute harness by two lengths of webbing, one sewn to each side of the parachute harness main sling. These lengths of webbing pass through web loops on the pararaft kit container and through the keepers which normally retain the parachute harness sling to the parachute pack.

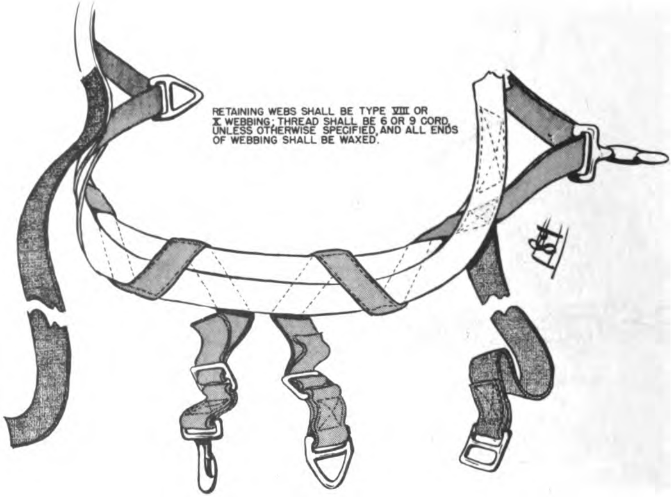

RETAINING WEBS SHALL BE TYPE VIII OR X WEBBING; THREAD SHALL BE 6 OR 9 CORD, UNLESS OTHERWISE SPECIFIED, AND ALL ENDS OF WEBBING SHALL BE WAXED.

Figure 184. — Method of sewing retaining webs of SS parachute to harness.

The method of sewing the retaining webs to the harness is illustrated in figure 184. Present harnesses are being manufactured with these retaining webs attached.

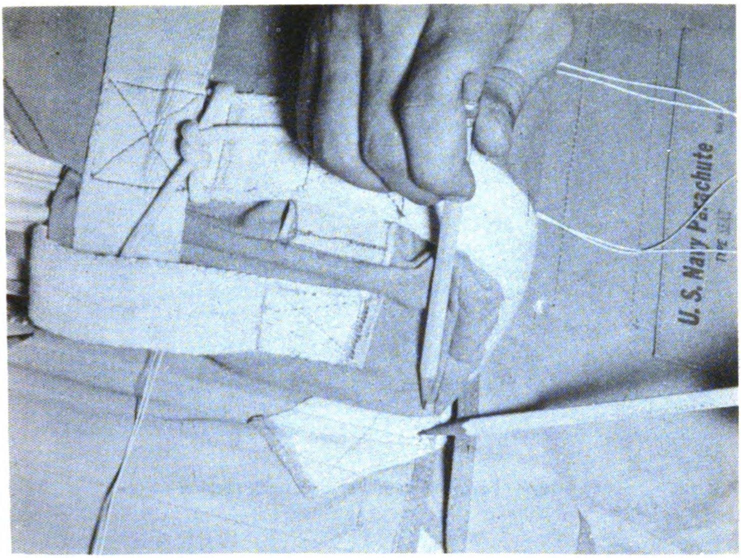


Figure 185. — Tacking points. (Opposite side is similarly marked.)

The pararaft kit is readily removed from the pararaft kit container in an emergency by use of the quick-release snap.

The following steps and illustrations outline the rigging procedure for the seat-type parachute:

Place the parachute on a packing table and "crack" the chute, drawing the canopy and shroud lines free of the pack. Remove the seat cushion, hand-pull pocket, and top and midpoint housing tackings. Break the lift web and all harness tackings, including the four keeper tackings. Disengage the pack from the harness by removing the box "X" sewings at the ends of the keepers nearest the locking-cone side of the pack. Free the raft retaining straps from the underside of the main sling. Re-sew keepers in place on the pack, making the regular box "X" sewing.

Fit the pararaft kit or case in the raft container as previously described under the QAC pack. Place the pararaft together with the container in position on the parachute pack as shown in figure 185.

Figure 186 illustrates the front marking and tacking points.

Thread the retaining webs through the web loops on the sides and bottom of the raft container, as shown in figure 187.

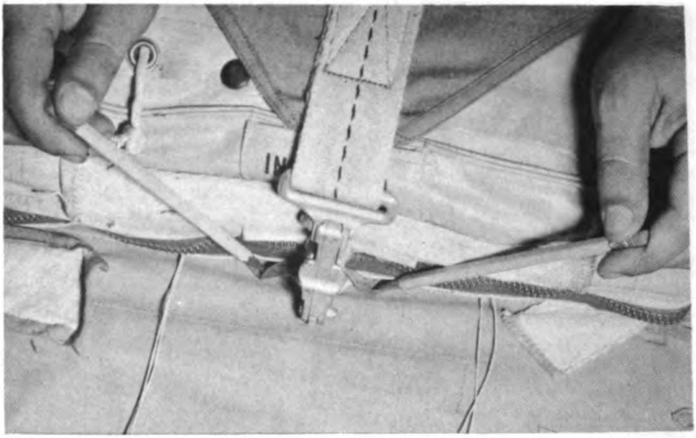


Figure 186. — Pararaft container and pack tacking points.

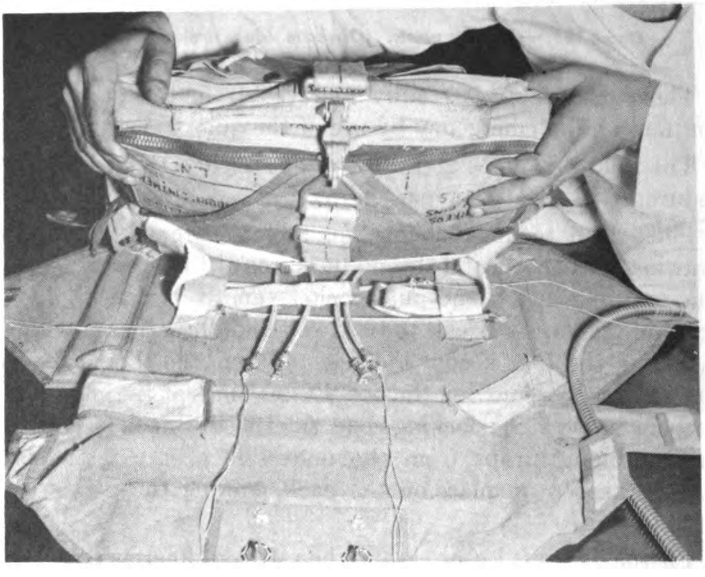


Figure 187. — Retaining webs threaded.

Pass the end of the web through the adapter on the end of the opposite web and draw taut to remove all possible slack. Tack the loose ends of the webs to themselves with No. 30 x 3 thread, doubled and waxed, two turns, to hold the adjustments

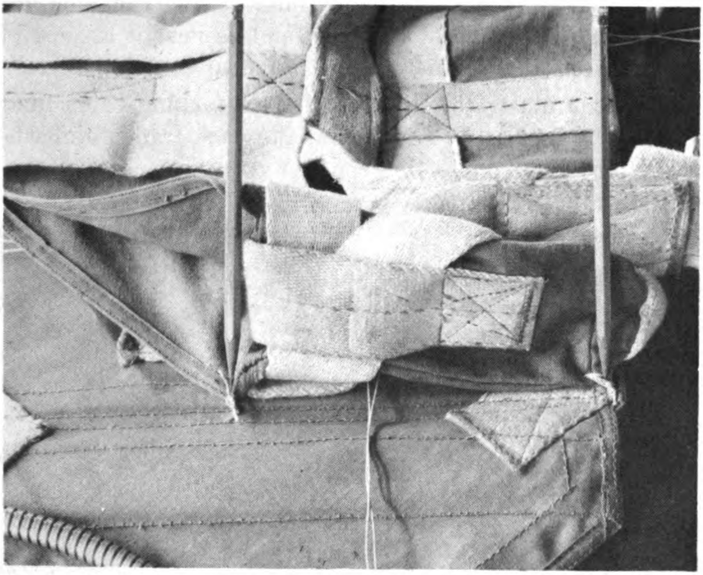


Figure 188. — Side-tackings of raft container and pack.

from slipping. Check the pack-opening elastics for wear, security, and passage.

Remove the raft from the container and make all tackings through the raft container and parachute pack. Tack together

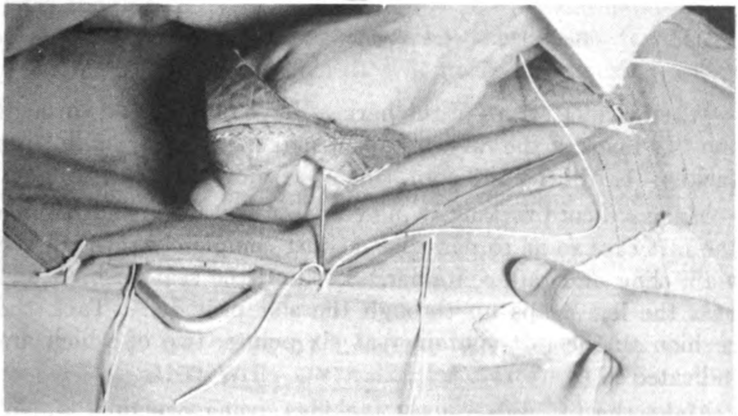


Figure 189. — Front tackings of raft container and pack.

with four turns of 9-cord, single and waxed. Tackings must pass around the frame of the pack and as near it as possible. Figure 188 shows a second side-tacking near completion.

Figure 189 illustrates the second front-tacking being made. See that the cord is passed around the pack frame, and when the six bottom tackings are completed, again insert the raft into its container.

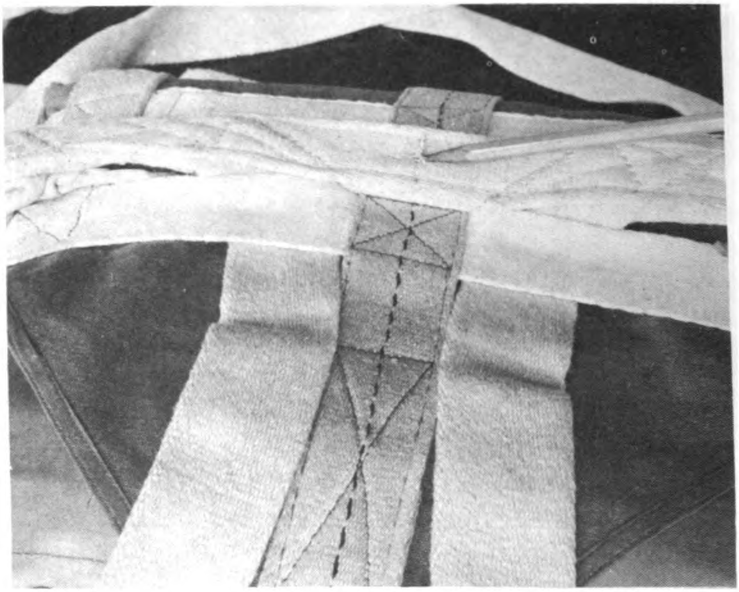


Figure 190. — Main sling tacking to raft container.

When the leg straps of the harness have been passed through the two loops in the raft container, make the center main sling tacking (two turns of 9-cord, single) as shown in figure 190.

Make a 6-cord tacking as indicated in figure 191, and remove the raft case so as to pass the tacking completely through the main sling and raft container. Position the seat cushion and pass the leg straps up through the slot provided. Tack the cushion to the raft container at six points, two of which are indicated in figure 192.

Make the lift web-to-pack tackings, using one turn of No. 30 x 3 thread double and waxed. Position the lift webs to

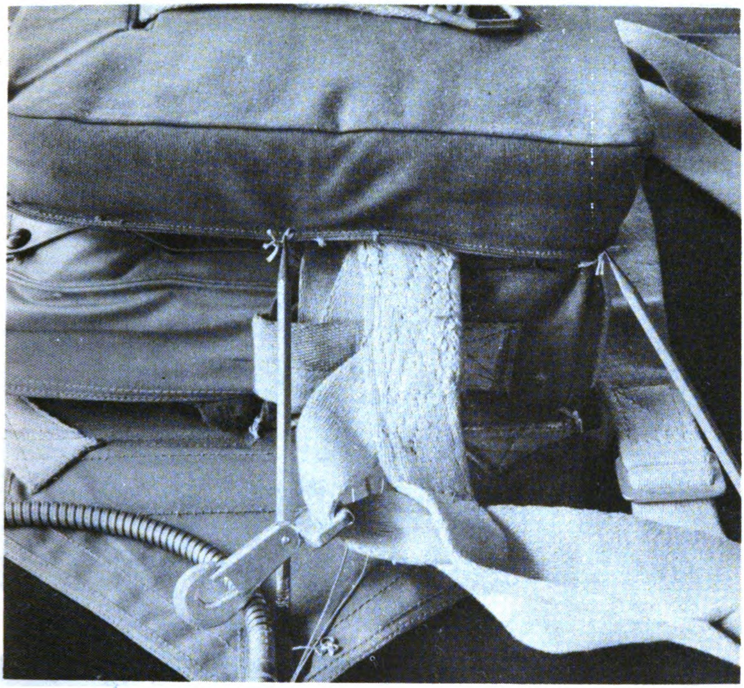


Figure 191. — Side tackings, seat cushion.

their maximum extension out of the pack as shown in figure 193, and position the back-pad.

Pack the parachute, re-positioning the housing and hand-pull pocket, following the previously described outline for this operation. Addition of the raft will lower the housing and hand-pull pocket on the harness. Permit no undue extension of the rip-cord cable between the housing ends and points of attachment.

Check the harness and even up all adjustments. Make certain that the raft retaining strap emerges from the raft case at the right-hand corner, opposite the rip-cord side of the pack, with the raft uppermost.

SS — 24- OR 28-FOOT CANOPY WITHOUT RAFT AND WITH OVERSIZE HARNESS

This combination is basically the same as the 24-foot canopy rigged without raft and with regular harness. Remember that

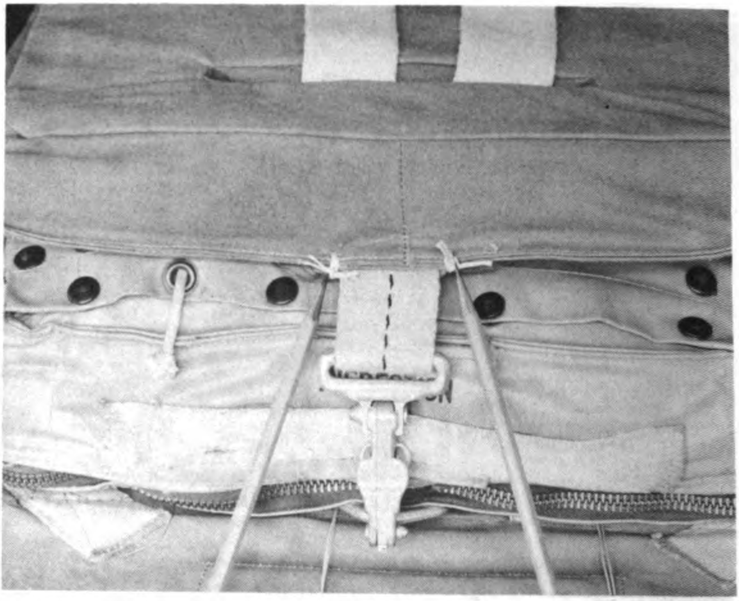


Figure 192. — Front tackings, seat cushion.

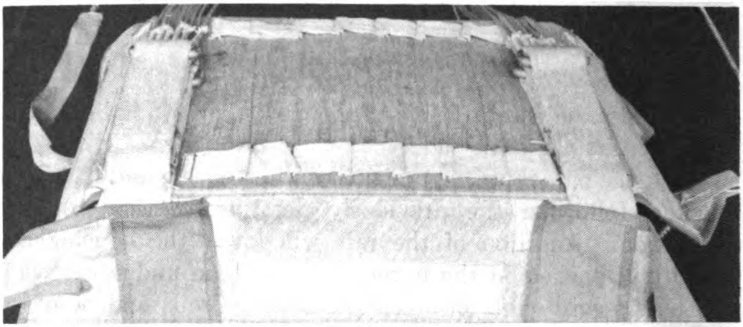


Figure 193. — Lift web sewings moved upward to edge of pack.

the canopy, harness, and pack must be larger than the regular size when packing and rigging the oversize unit.

SS — 24- OR 28-FOOT CANOPY WITH OR WITHOUT RAFT AND WITH QUICK-FIT HARNESS

Sufficient information has been given in the preceding pages for handling these combinations.

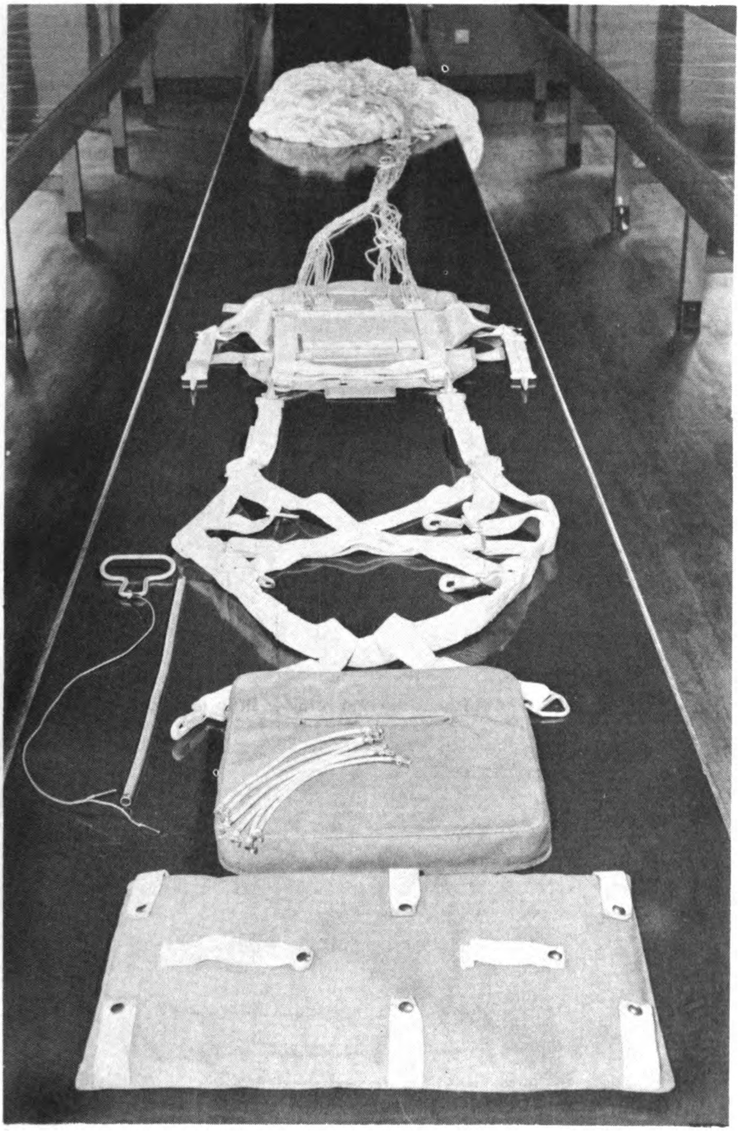


Figure 194. — QAS parachute assemblies.

QAS — 24-FOOT CANOPY WITHOUT RAFT AND WITH REGULAR HARNESS

Figure 194 illustrates the various assemblies of this unit laid out on a packing table.

The following four illustrations — figures 195 to 198, inclusive — furnish sufficient information to enable you to properly rig the QAS unit without raft.

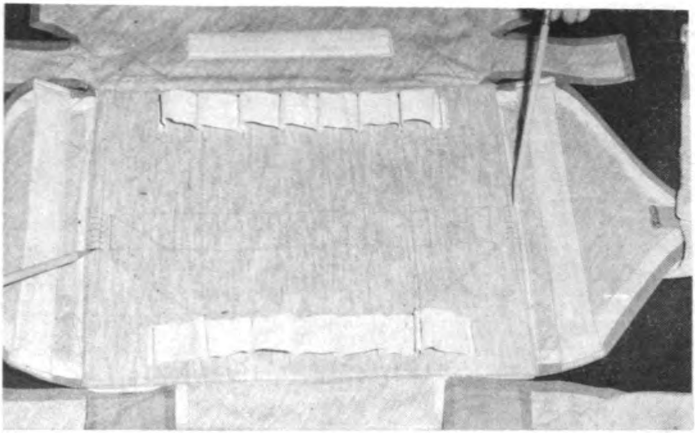


Figure 195. — QAS pack showing retainer strap tackings.

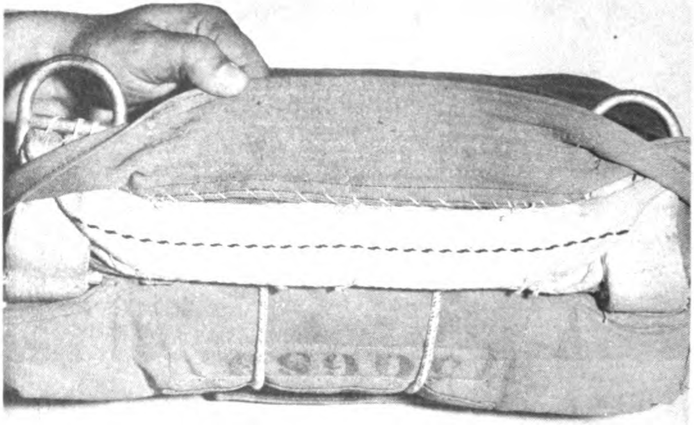


Figure 196. — Method of tacking lift web assembly to pack and seat cushion.

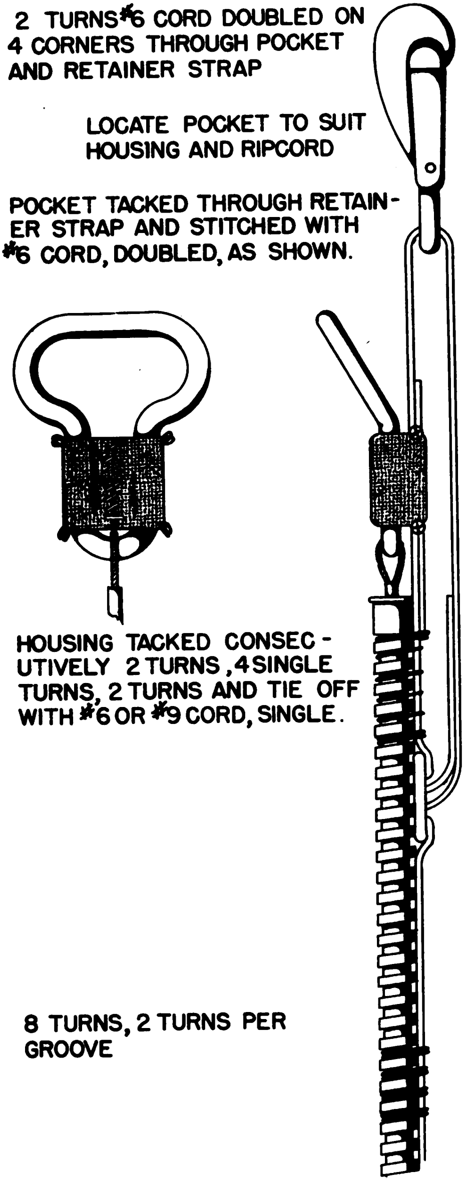
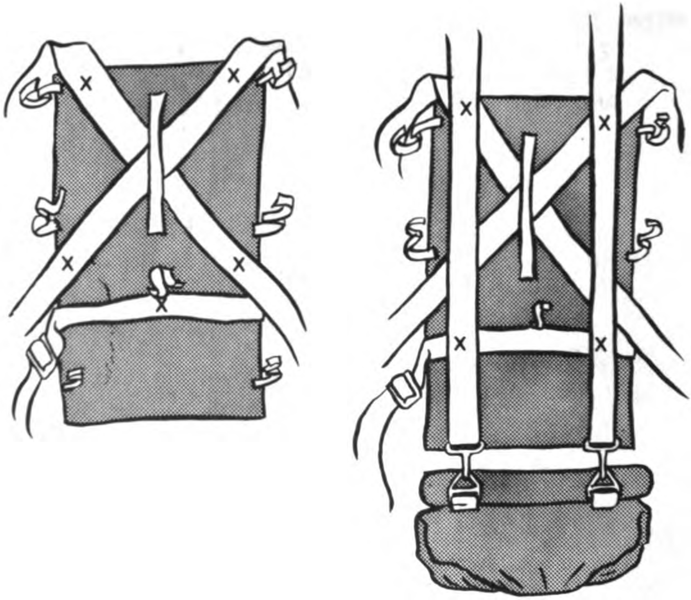

2 TURNS #6 CORD DOUBLED ON 4 CORNERS THROUGH POCKET AND RETAINER STRAP
LOCATE POCKET TO SUIT HOUSING AND RIPCORD
POCKET TACKED THROUGH RETAINER STRAP AND STITCHED WITH #6 CORD, DOUBLED, AS SHOWN.
HOUSING TACKED CONSECUTIVELY 2 TURNS, 4 SINGLE TURNS, 2 TURNS AND TIE OFF WITH #6 OR #9 CORD, SINGLE.
8 TURNS, 2 TURNS PER GROOVE

Figure 197. — Method of attaching rip-cord housing to pack and retaining strap.



I TURN 6 CORD SINGLE AND WAXED. START STITCHING FROM WEBBING SIDE.

I TURN 30 X 3 DOUBLED AND WAXED. START STITCHING FROM WEBBING SIDE. TACKING THROUGH KEEPERS OPTIONAL.

Figure 198. — Method of tacking harness.

Notice the clover-leaf hand-pull in figure 197. This is the only service parachute, other than the QAC, utilizing this design.

SB — 24-FOOT CANOPY WITHOUT RAFT AND WITH REGULAR HARNESS

Consult the following illustrations for instructions on working with this unit. The hesitator loop arrangement has been modified locally to conform with the conventional layout.

When folding the canopy onto the container, make the folds approximately three inches longer than the container to provide solid pack ends. This will insure retention of the end flaps and give sufficient strength and support to the rip-cord housing to facilitate pulling the rip cord in an emergency.

Close the top flap of the container and lock the cone with the top rip-cord pin as described in figure 207, to make room for the pilot chute. Run the right hand along the lines to gather them at the skirt as shown in figure 208.

Holding the gathered lines in the left hand, pass the index finger of the right hand through the vent of the pilot chute from the top and grasp the gathered lines, releasing them from the left hand. The left hand is then used for folding the two wings marked "FOLD DOWN" as shown in figure 209.

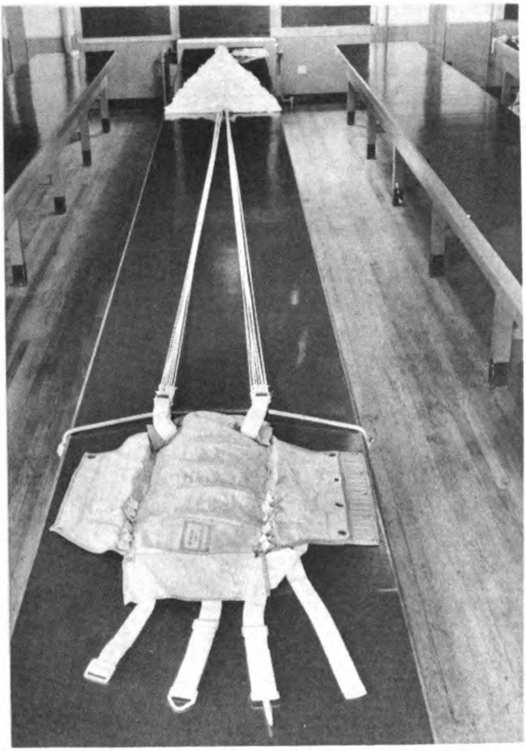


Figure 199.— SB unit laid out for inspection with risers tacked to top edge of pack.

The shroud lines and the two wings marked "FOLD DOWN" are held while the two wings marked "FOLD UP" are folded and held in place with the right hand. This procedure is illustrated in figure 210.

Figure 200. — Canopy whipped and folded to conform to width of pack. No shroud-line holder is necessary.

Turn the pilot chute over so that the UP wings are on top and run parallel to the side flaps of the container as shown in figure 211.

Holding the pilot chute between the hands, right hand uppermost, left hand and shroud lines below, insert the pilot chute under the side flaps of the pack with wings folded beneath the side flaps of the pack as illustrated in figure 212.

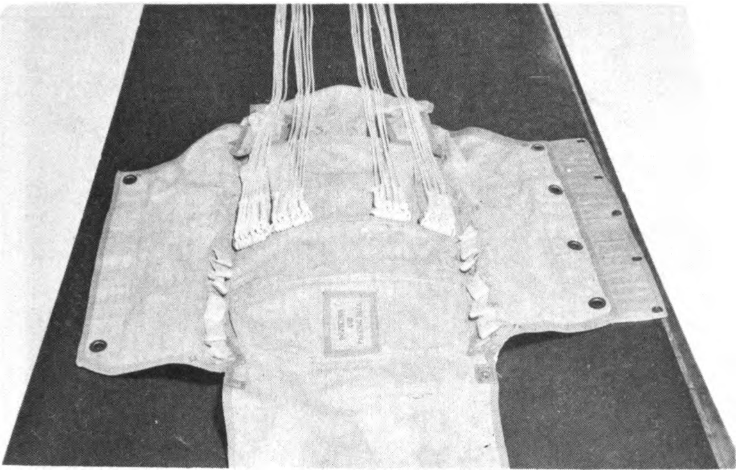


Figure 201. — Tacking points of links in pack.

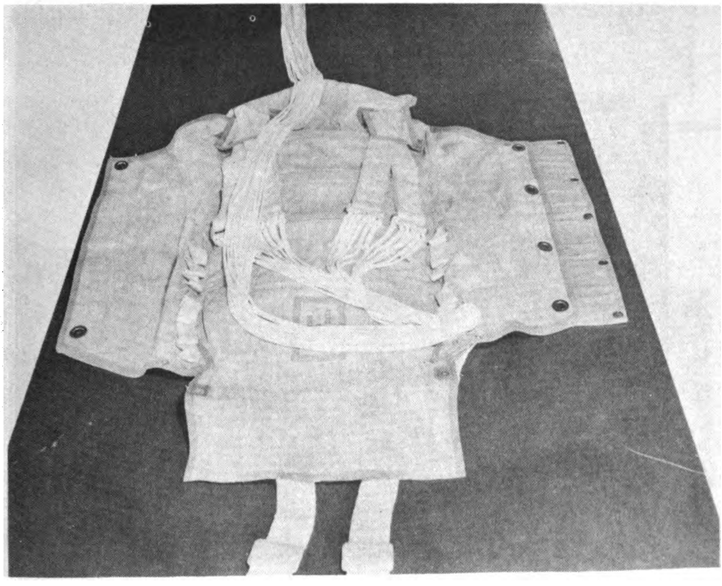


Figure 202. — First bight of line taken in hesitator loop.

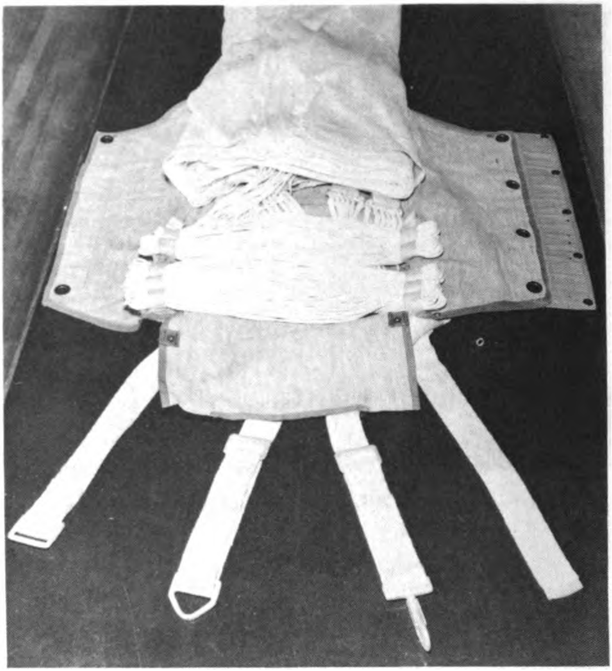


Figure 203. — Shroud lines held in hesitator loops and edge of skirt laid in position on the pack.

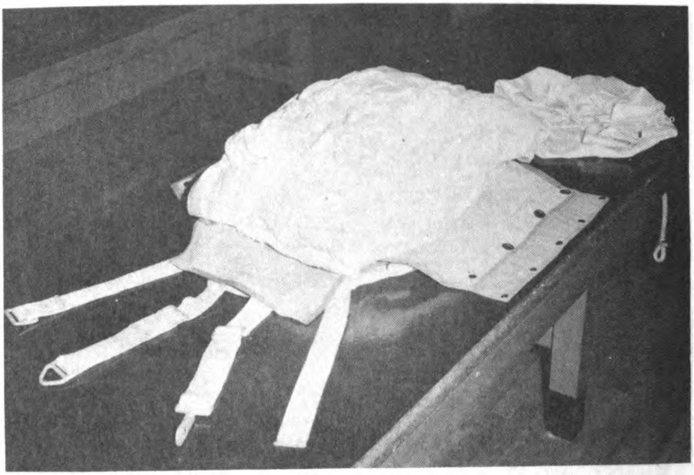


Figure 204. — All folds made and peak turned under.

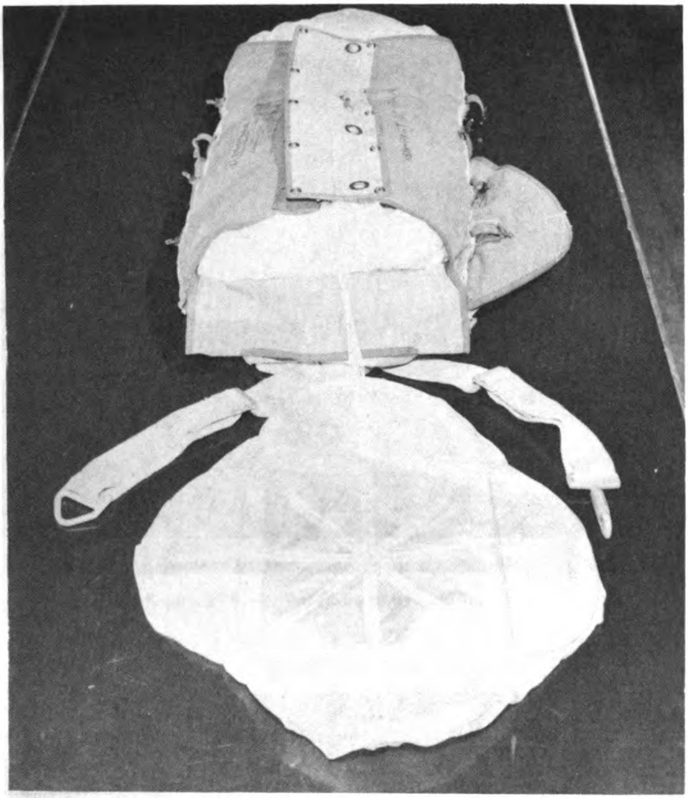


Figure 205. — Side flaps held in place by one temporary pin in the Number 2 cone.

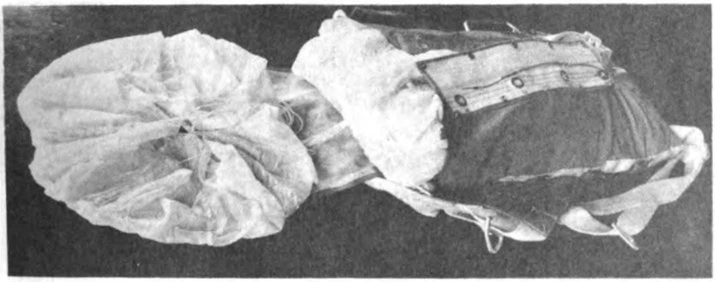


Figure 206. — End flap closed and top pin of rip cord in place.

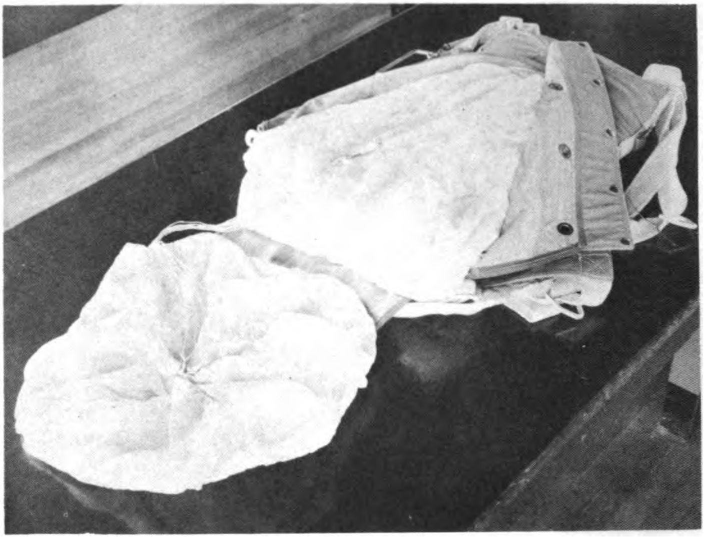


Figure 207. — Side flaps spread preparatory to stowing pilot chute.

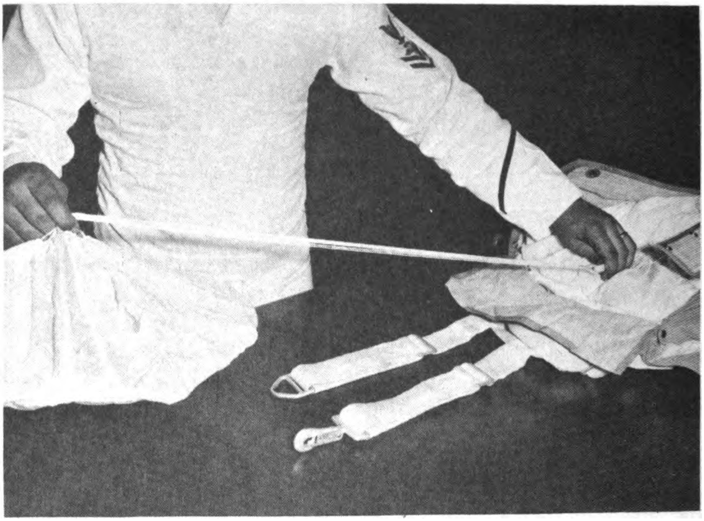


Figure 208. — Straightening lines.

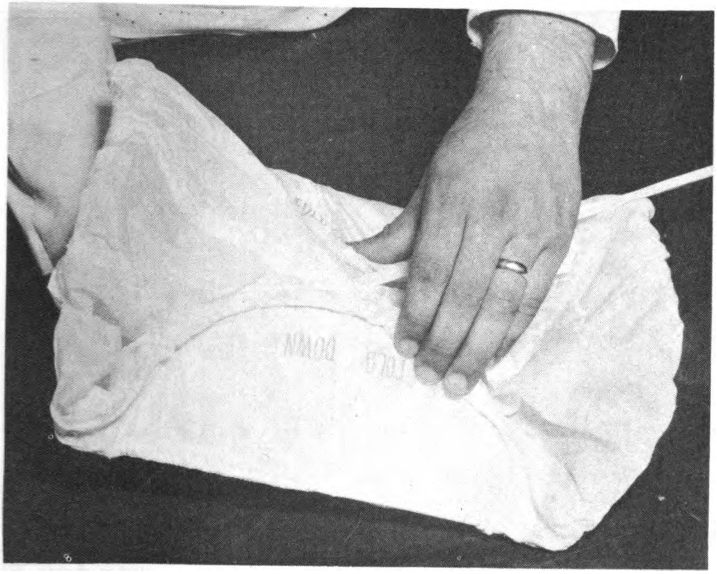


Figure 209. — First flaps folded down.

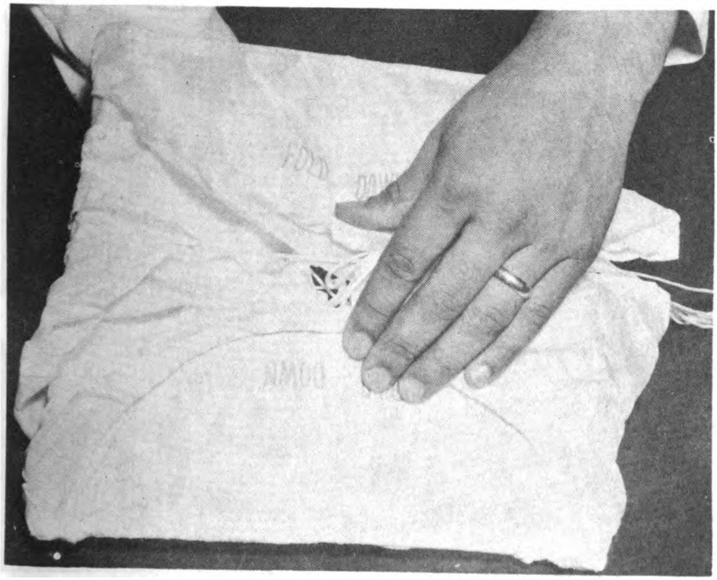


Figure 210. — Four pilot chute flaps folded.

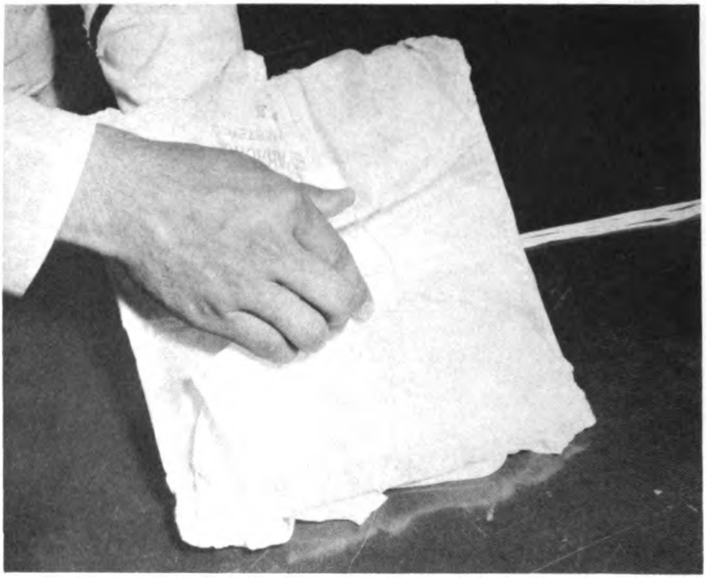


Figure 211. — Pilot chute ready for insertion in pack.

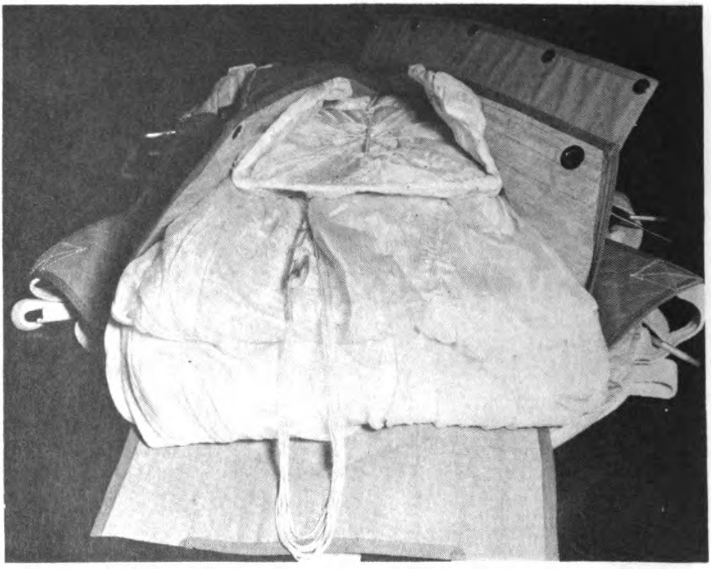


Figure 212. — Pilot chute inserted in pack.

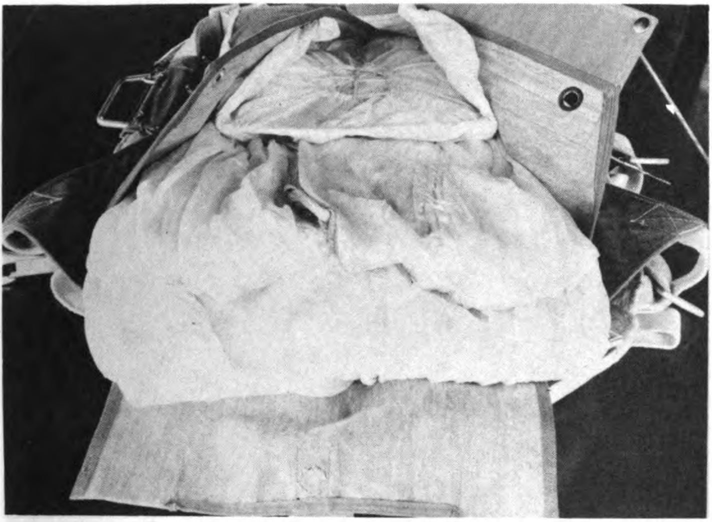


Figure 213. — Pilot chute lines in stowed position.

After centrally locating the pilot chute beneath the two center locking cones, "accordion-fold" the pilot chute shroud lines in the manner shown in figure 213, tucking them under the short top fold of the main canopy.

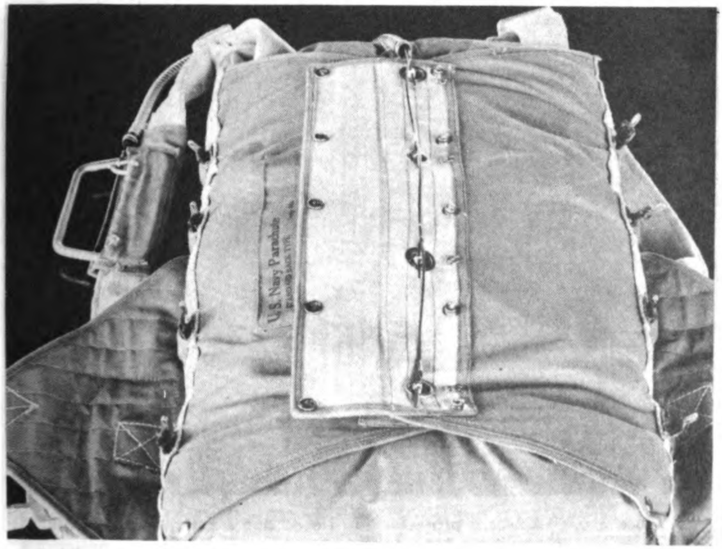


Figure 214. — Pack closed and rip-cord pins in place.

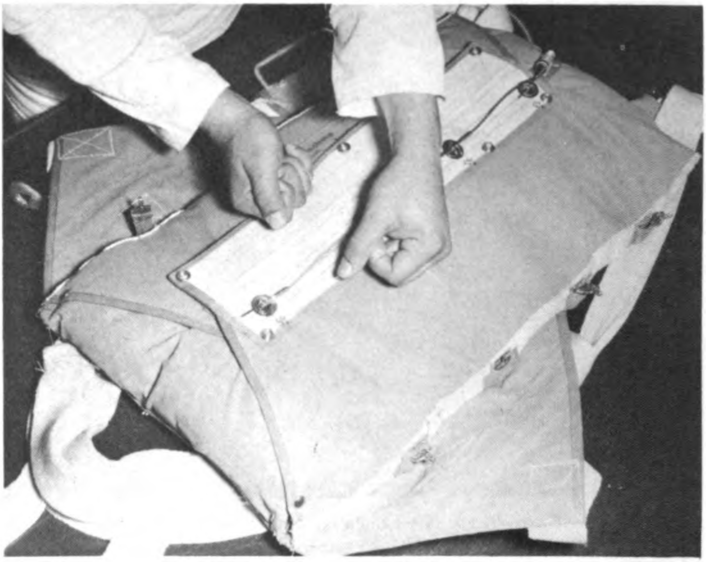


Figure 215. — Safety-tying bottom rip-cord pins.

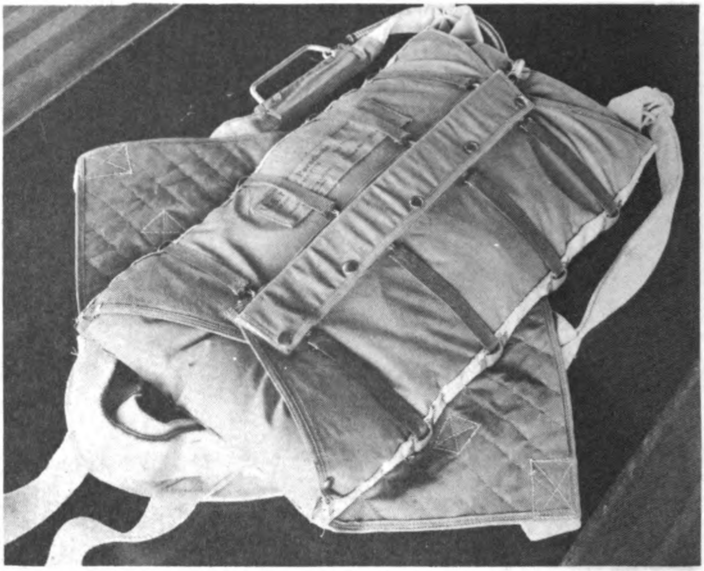


Figure 216. — Rip-cord protector flap closed and pack-opening elastics hooked in place.

Figure 217 illustrates the method of threading and securing the short webbing-retainer affixed to the lower side of the pack protector flap or wing. The webbing passes through the adapter sections of the "V" ring on one side and the hook-up snap on the opposite side of each upper leg-strap extension. Each end is secured through the double adapters provided.

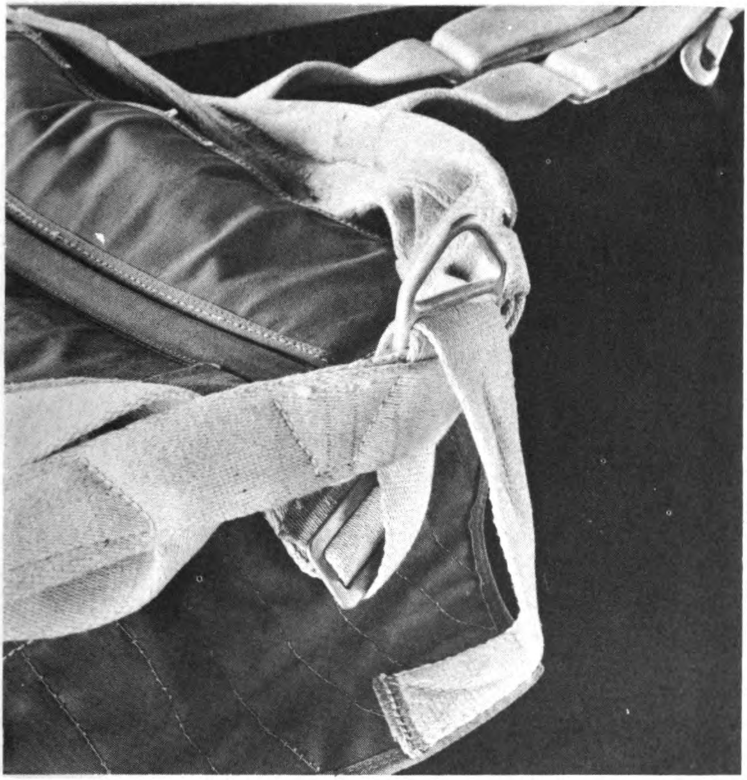


Figure 217.— Method of securing SB pack wings.

SB — 24-FOOT CANOPY WITH RAFT AND WITH REGULAR HARNESS

It is not necessary to unpack the SB unit in order to rig it with the pararaft kit. This kit is attached to the parachute by two lengths of webbing, one sewn on each side of the parachute harness main sling. The pararaft kit or case is readily removed

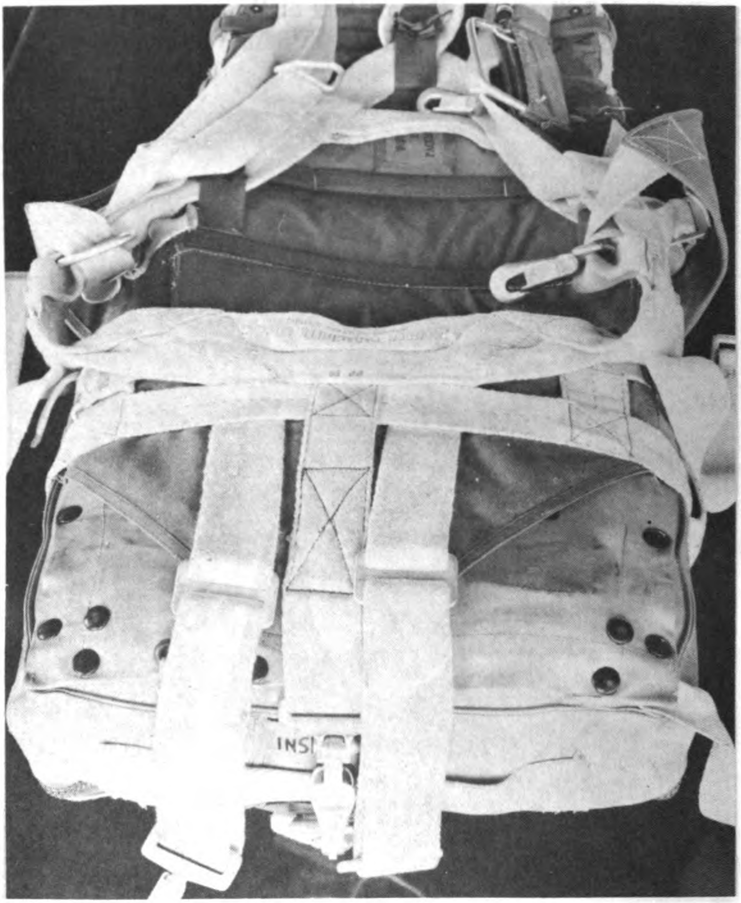


Figure 218. — Leg straps inserted under the web loops.

from the container in an emergency by use of a quick-release snap. The method of rigging this chute with the raft is explained in the following text and illustrations.

Fit the raft case to the container. The harness seat-sling runs across the pararaft container, and the leg straps are inserted UNDER THE WEB LOOPS as demonstrated in figure 218.

Thread the retainer straps through the side and bottom loops provided in the raft container, as shown in figure 219.

Secure the webbing in the adapter and tack with one turn

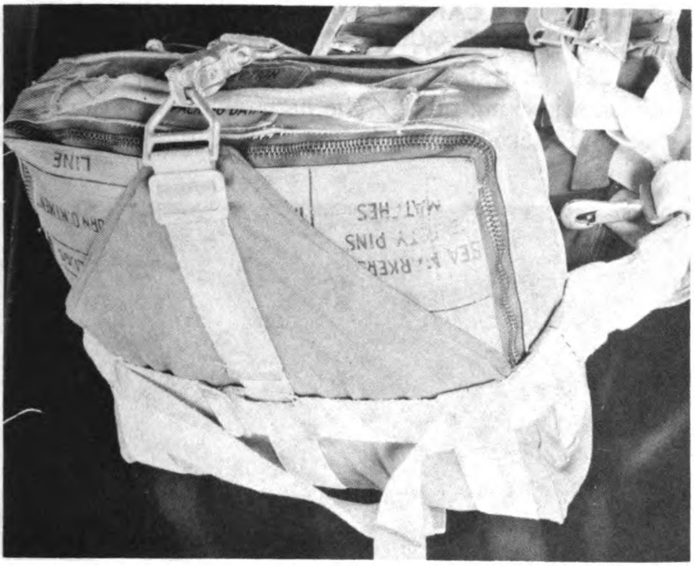


Figure 219. — Threading retainer straps.

of 6-cord. Place the seat cushion, running the leg straps through slots, and tack at six points. Two side-tackings are shown in figure 220. Two additional tackings are made on the opposite side and two in the front. This is also shown in figure 220.

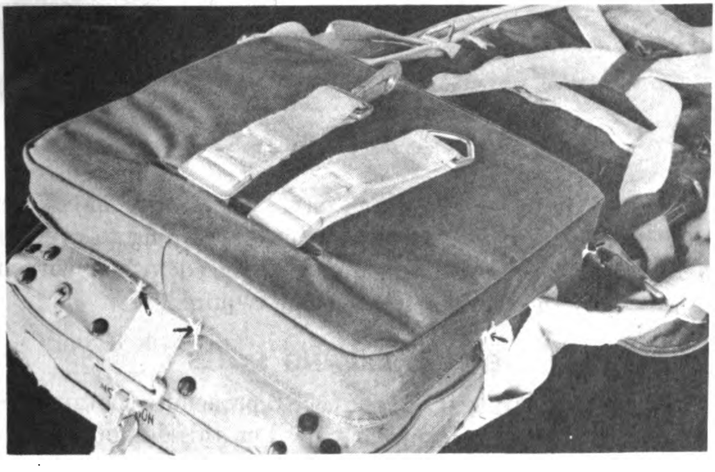


Figure 220. — Front and side tackings.

SB — 24-FOOT CANOPY WITH OR WITHOUT RAFT AND QUICK-FIT HARNESS

Figure 221 illustrates the quick-fit SB harness and canopy laid out on a packing table. The harness lift webs have been attached and tacked to the links preparatory to making the machine sewings.

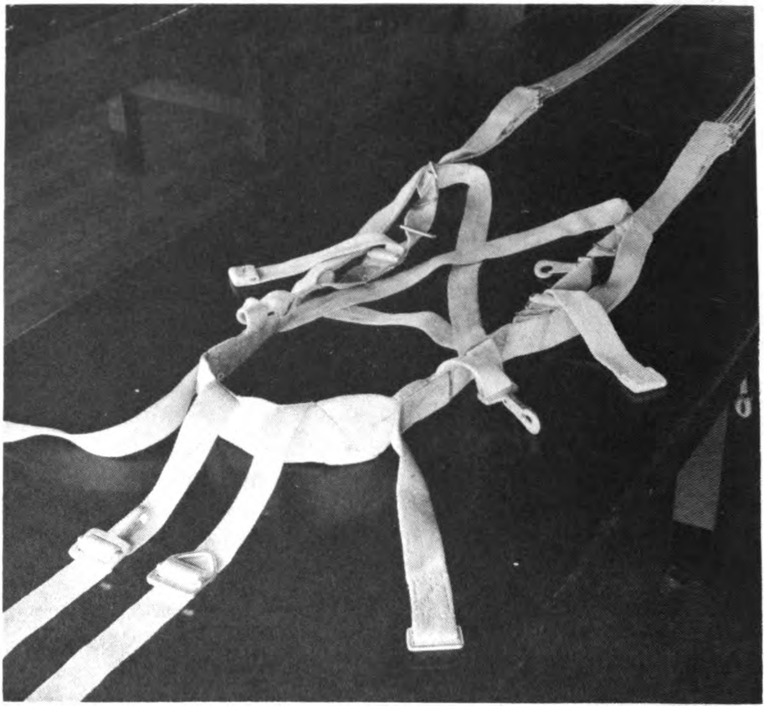


Figure 221. — Attachment of QFB harness to canopy.

After the harness, pack, and other accessories have been properly assembled, pack the parachute according to previous instructions. The QFB harness may be rigged with or without the raft, only the retainer straps being required.

GENERAL RIGGING NOTES

Figure 222 illustrates two types of SB parachute containers — rear and inside views — currently used on this design. View A shows the backs of the containers and points out attachment webbings. The attachment points of number one must be sewn with the conventional box "X" sewings, while number two is simply laced to the harness.

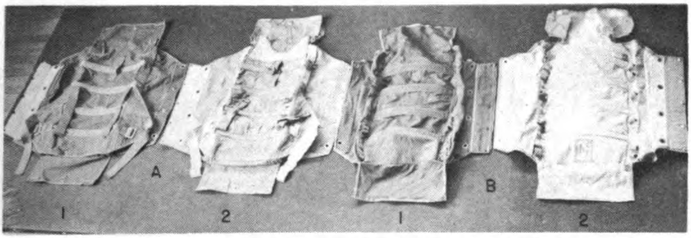


Figure 222. — SB parachute container.

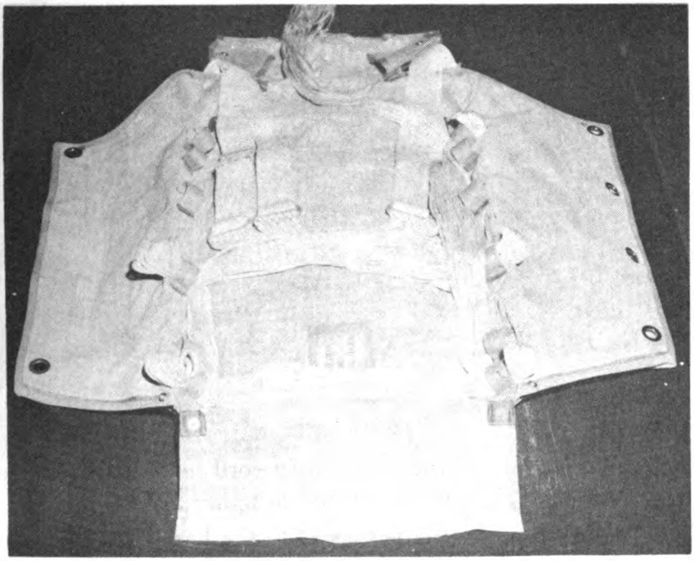


Figure 223. — Method of stowing shroud lines in unconventional hesitator loop arrangement.

View B shows the inside arrangement of the hesitator loops of containers one and two. The arrangement in container one follows the conventional line. Container two, however, differs decidedly, as does the method of stowing the shroud lines, illustrated in figure 223.

The harness tab panel is secured in the vicinity of the shoulder adapters with a short length of 3/16 bongee. This elastic is threaded through the container slot and between the webs forward of the shoulder adapters. The ends of the elastic are lapped 3/4-inch and sewn together with eight turns of 6-cord, using an overhand spiral sewing. This prevents the pack from sliding down the wearer's back. Figure 224 shows the rip-cord housing tackings.

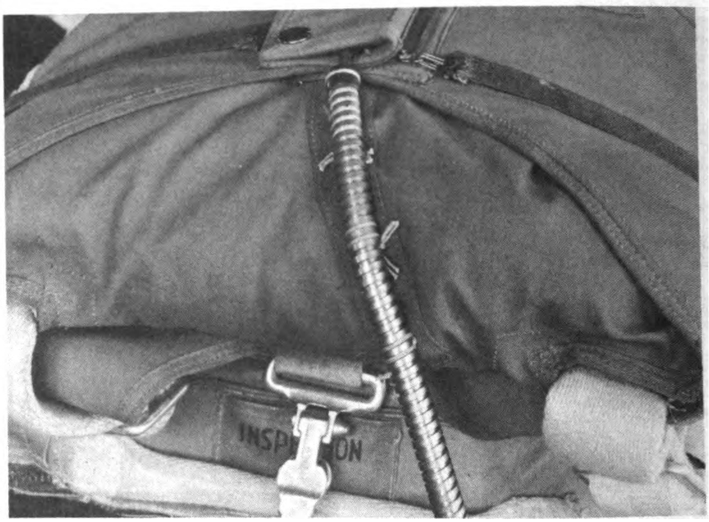


Figure 224. — Pack and rip-cord housing tacking.

The opposite end of the 21-inch rip-cord housing is attached to the harness at a point illustrated in figure 225.

Notice that the housing is tacked to the hand-pull pocket on this particular design. When this pocket is unavailable, use the regular trapezoid hand-pull pocket employed on SB parachutes.

After the housing and hand-pull pocket have been tacked in place, check to make certain that the COMPLETELY PACKED PARACHUTE, WITH SAFETY THREAD IN PLACE AT LOCKING PINS, WILL NOT PREMATURELY OPEN OR SHOW ANY MOVEMENT OF THE LOCKING PINS WHEN GRASPED JUST ABOVE THE HAND-PULL POCKET. Figure 226 shows a detailed drawing of this hand-pull pocket (NAF 312027-1).

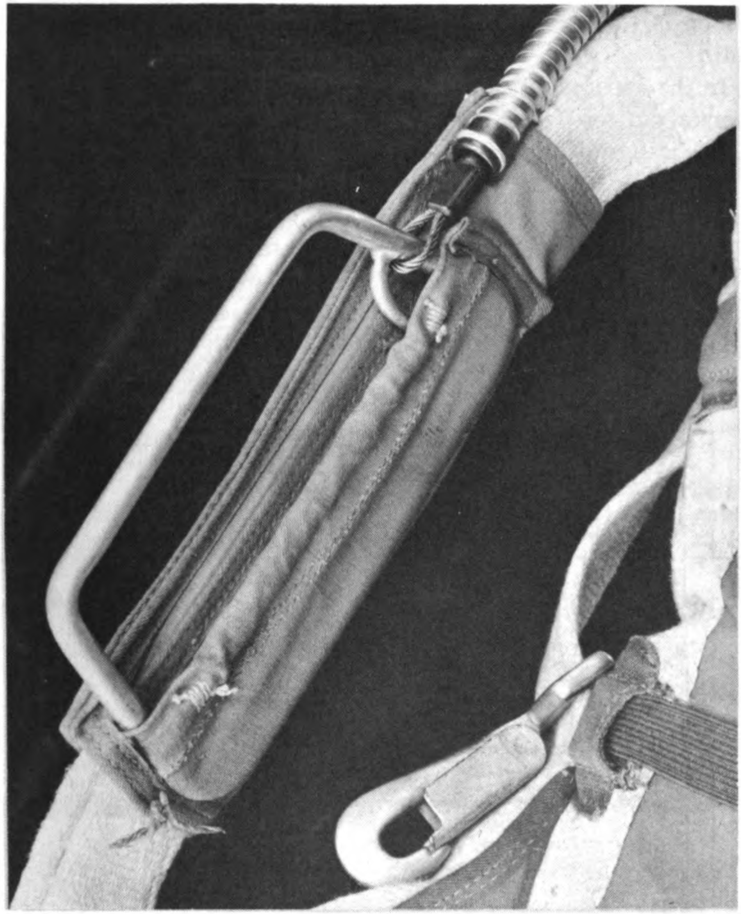


Figure 225. — Harness housing tacking and position of hand-pull pocket.

THE TRAINING OUTFIT — TB 28-FOOT CANOPY WITH REGULAR HARNESS

The training pack, together with a reserve parachute, is used exclusively for premeditated jumps. The TB is a dual-purpose unit. Two separate rip-cord assemblies are incorporated into the pack, either of which may be used, depending upon the type of premeditated jump.

The TB, when rigged with a static line, is packed in the same manner as for free-fall, except that the pilot chute is normally eliminated, and a loop at the peak of the canopy is secured to a loop in the static line rip cord by several turns of breakable cord.

In the event that the static-line rip cord fails to function, the manual rip cord, used for free-fall jumps, may be used.

For information as to packing and rigging this parachute — without static line — consult the following steps and illustrations.

Lay out the chute and rig the container to the harness. Figure 227 describes the method of tying webbing keepers over the cross-shoulder straps and back strap. No sewing is required.

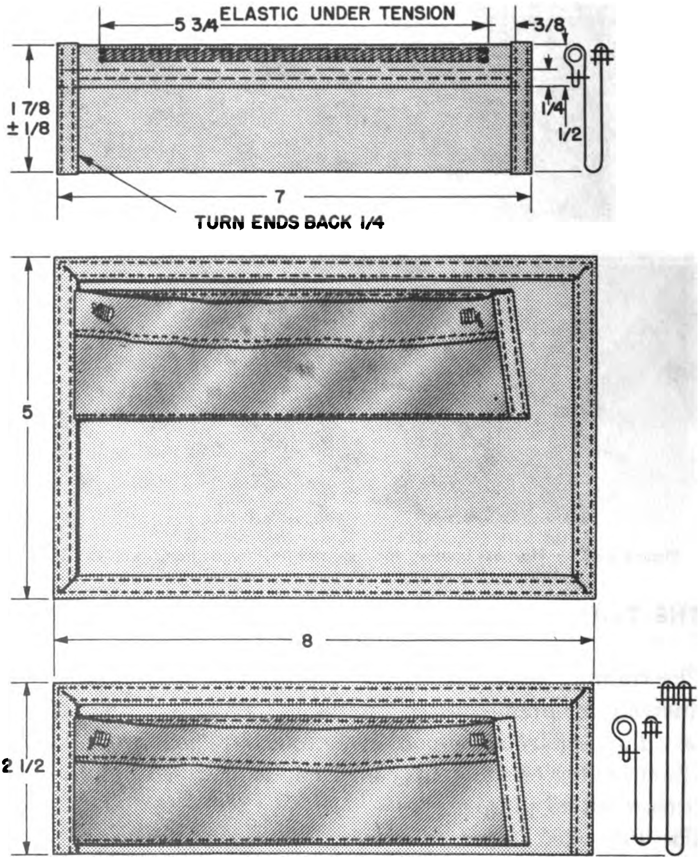


Figure 226. — Hand-pull pocket.

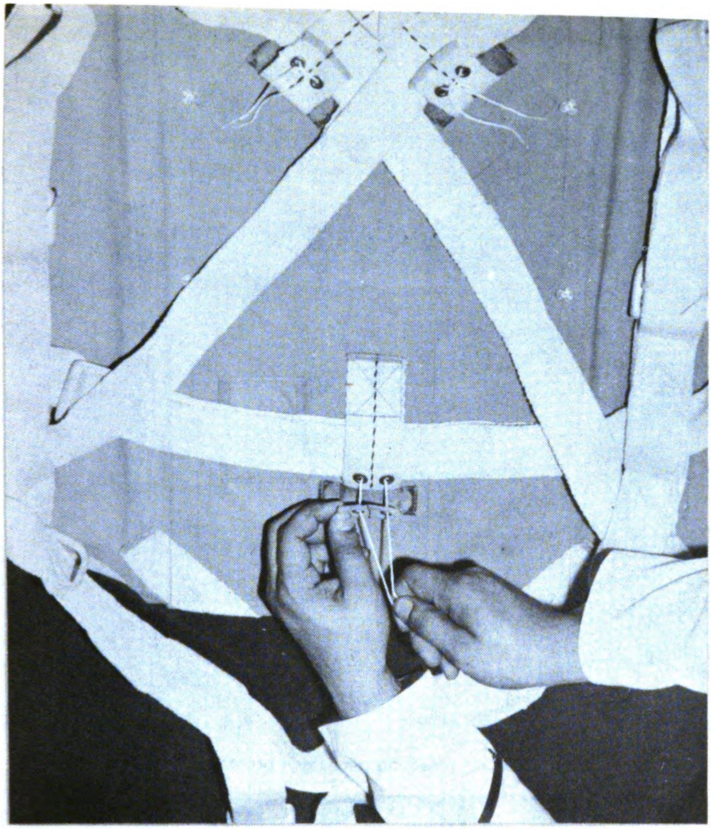


Figure 227. — Method of securing TB pack to harness.

This chute contains no back pads or seat cushions. To secure the pilot-chute protector flap with modified top rounded corners to the pack, study figure 228.

The open edges of the protector flap run parallel to the left edge of the pack. The static-line rip cord pins are passed through the elastics acting in the same capacity as cones to hold the flap securely to the right-side flap. "Safety-tie" the top and bottom pins, noting that no static line is present.

Note also that there are but three cones and grommets close the pack before positioning the 21-inch rip-cord housing. Mark off a 3/4-inch area from the top of the protector flap, with

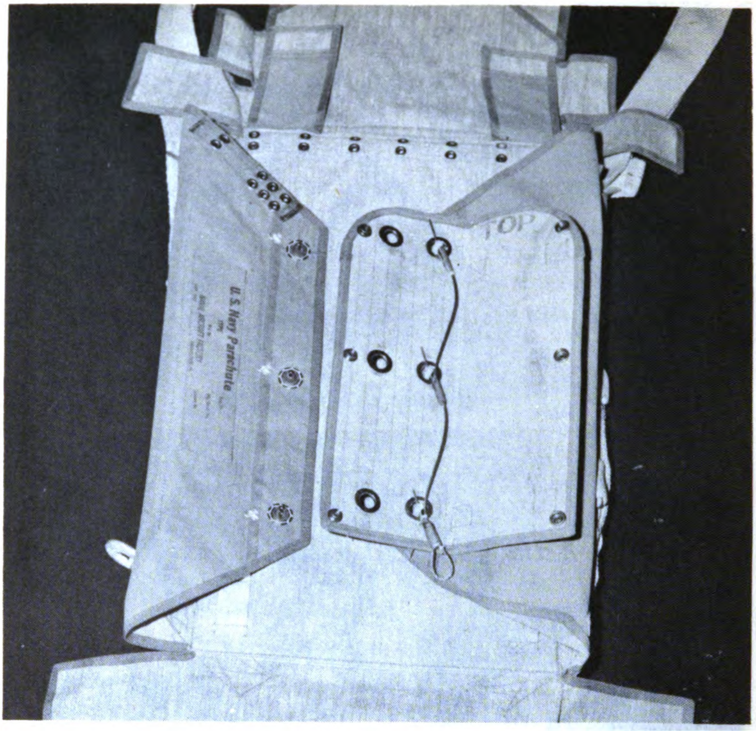


Figure 228. — Attaching pilot-chute protector flap.

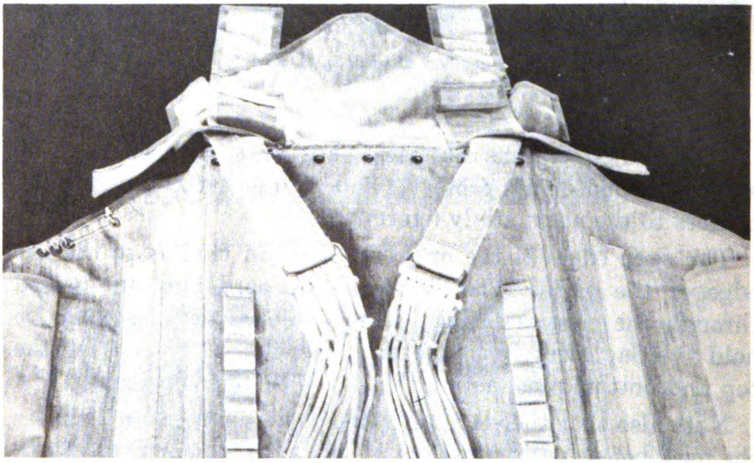


Figure 229. — Lift webs tacked in TB pack.

the grommets over the cones and held in position, at the point where the mouth of the housing is to be located.

Tack or tie the lift webs in the container as shown in figure 229. The following three figures — 230, 231, and 232 — illustrate the slight variation in the methods of packing the parachute.

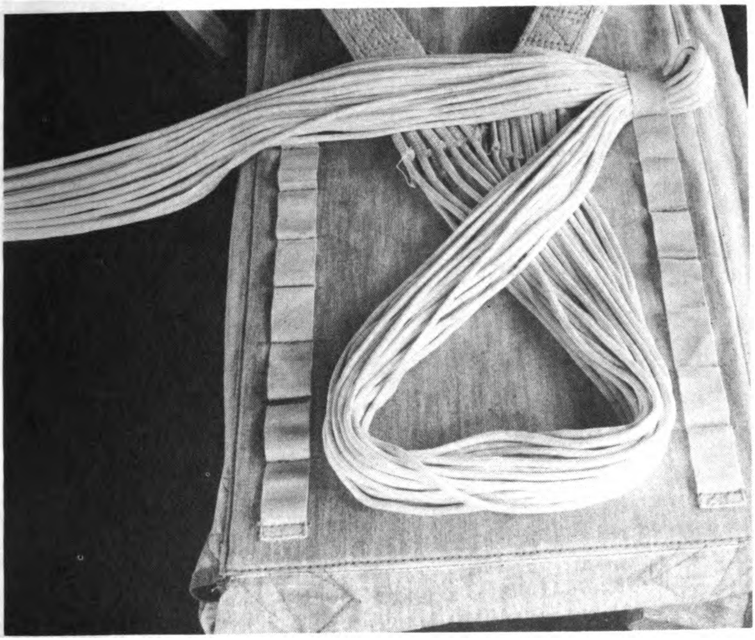


Figure 230. — The first bight of line taken in a hesitator loop.

The remaining packing procedures are the same as for any other standard service parachute.

TC — 24-FOOT CANOPY WITH HOLD-DOWN STRAP

The TC, or reserve, parachute is a converted QAC. In assembling this unit, the canopy is laid out with the manufacturer's stamp down and the quick-connector snaps also facing the table, as shown in figure 233.

Enter the lift webs in the container as shown in figure 234.

Bring the quick-connector snaps back on the lift-web assembly, and make an inverted QAC tacking. Pack the chute as you

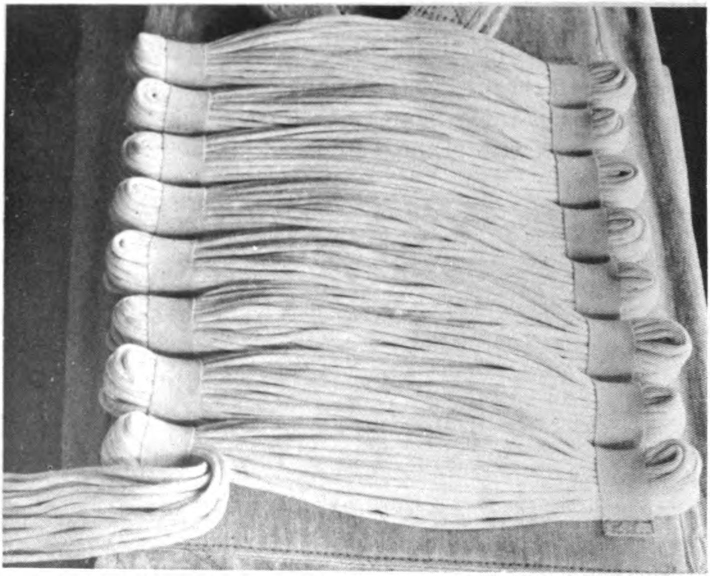


Figure 231. — The last bight of line.

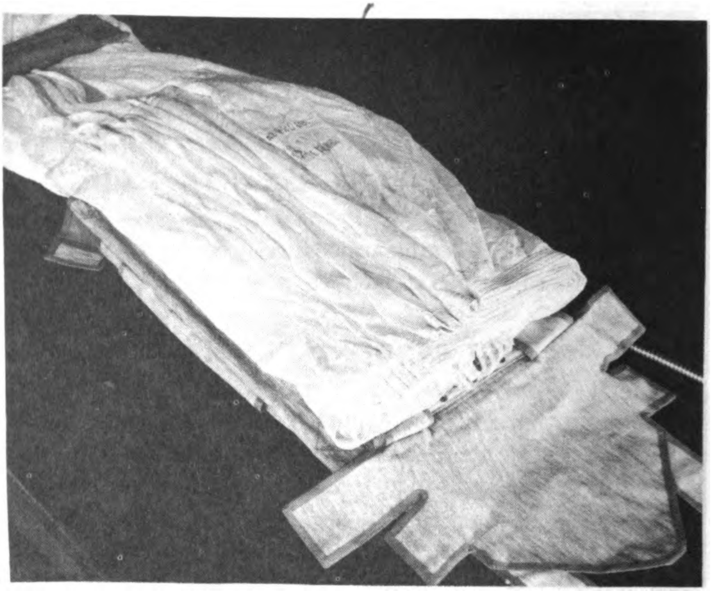


Figure 232. — Skirt brought to top of pack.

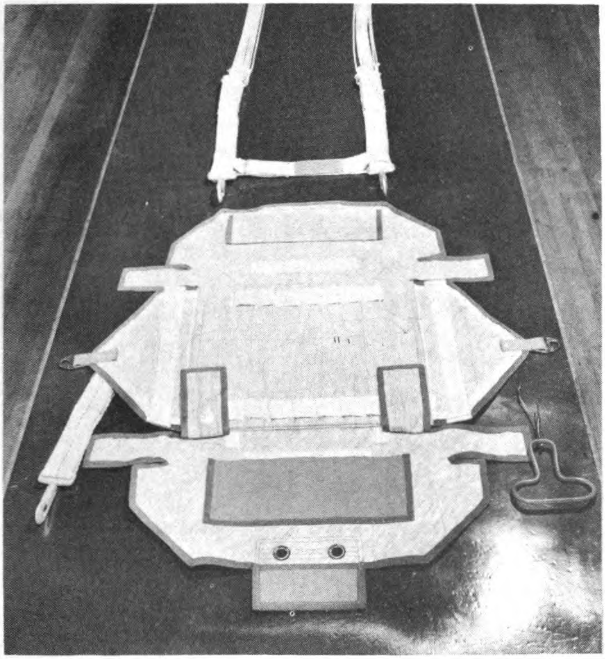


Figure 233. — TC laid out prior to tacking lift web assembly to pack.

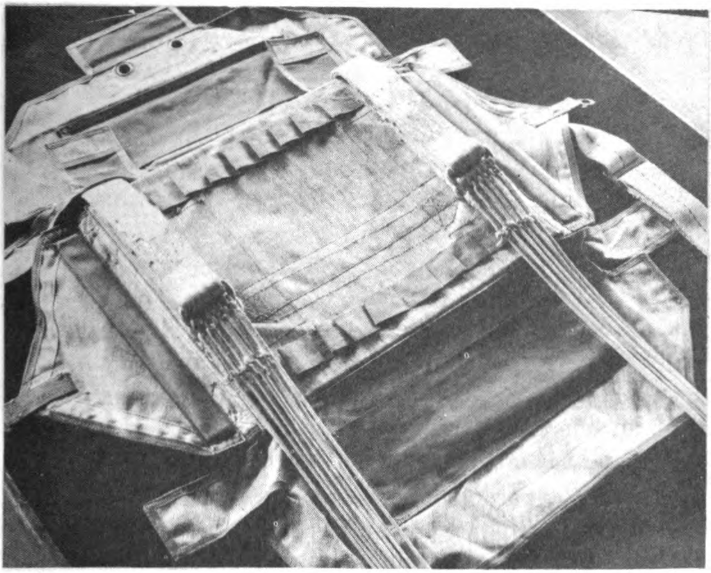


Figure 234. — Lift webs entered in the pack.

would a QAC. It is not necessary to stow a pilot chute — the pilot chute connector cord may be removed or simply made into a small loop and secured. When you enter the rip cord, turn the handle DOWN. This prevents accidental cracking of the chute, and also indicates that the pilot chute has been removed. This principle is illustrated in figure 235.

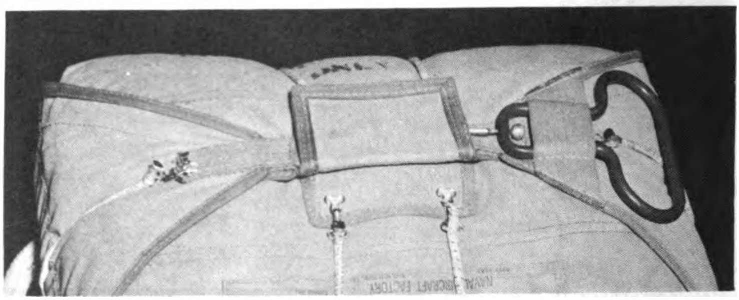


Figure 235. — Rip-cord handle turned down.

The HOLD-DOWN, or "belly" strap firmly holds the TC "in" to the wearer's body. In the event of a severe opening shock, the TC will not be carried out of reach by the breaking of the lift-web tackings.

Figure 236 is a side view of the training outfit fully rigged and ready for use.

"MAKING THEM FIT"

The regular standard harness is composed of four main lengths of webbing, each capable of supporting 5000 pounds. Two lengths form the sling (standard fixed-type) and take the majority of strain when the parachute opens.

These main pieces are not sufficient, however, to prevent the wearer of the chute from falling out. BODY STRAPS are therefore included. Another two lengths of webbing are added along with the hardware for connections, and by entwining them in, between, and around the main sling according to a certain pattern, an effective harness is made. Figure 237 shows the leg straps and the cross-shoulder straps being made.

Next, after the harness is formed and the hardware has been fitted, sew the webbing together according to the pattern. Body straps are left free to permit adjustment. The majority of

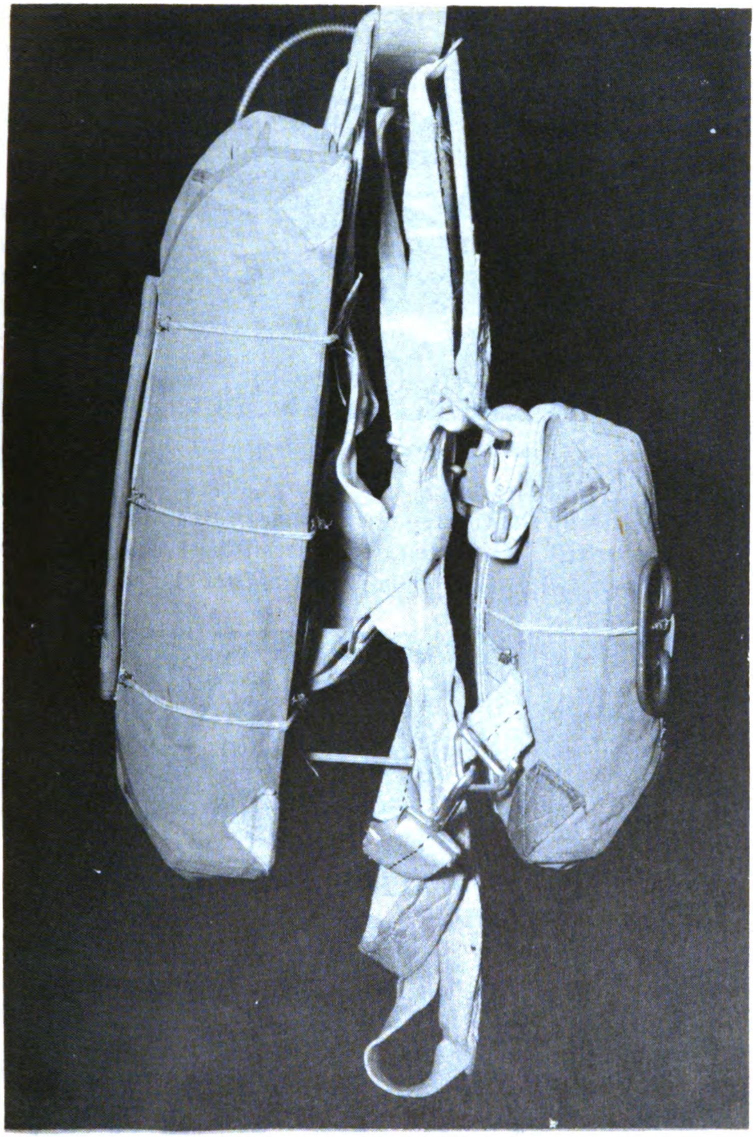


Figure 236. — Training outfit fully rigged.

harness adjustments are made in the body straps by manipulation of adapters. In figure 238, all points of adjustment have been singled out.

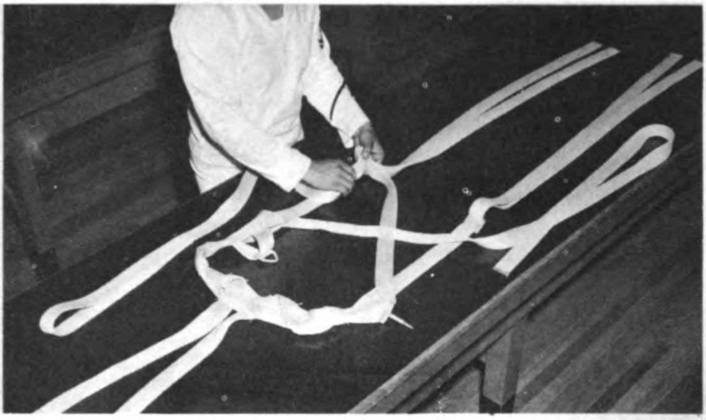


Figure 237. — Passage of body straps.

The back strap shown in figure 238 constitutes the terminating point for both body straps so that all reserve webbing is concentrated in this part. The more compact the adapters in

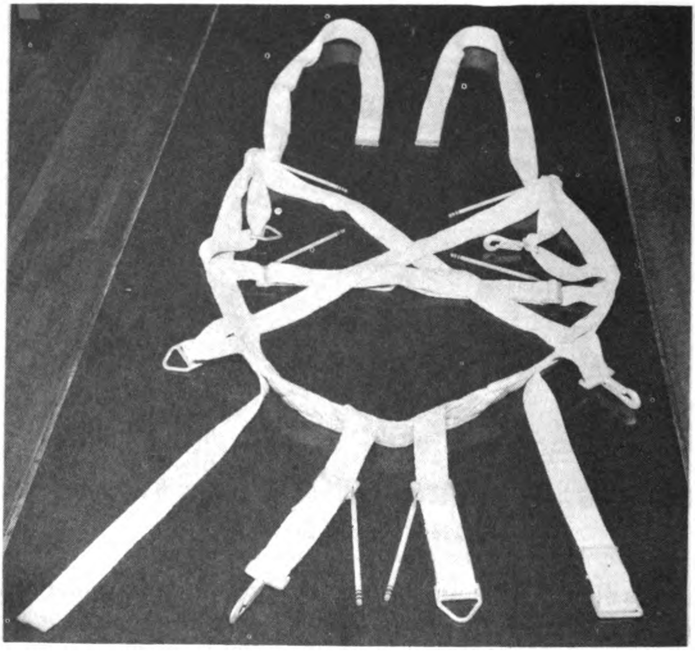


Figure 238. — Harness adjustment points.

this strap become, the more webbing is placed into the chest strap.

When all excess webbing is moved into the chest strap, it should be equalized throughout the remainder of the harness. Slip the chest webbing through the shoulder adapters and into the cross-shoulder straps as shown in figure 239. This adjustment will bring the upper leg strap extensions well out from the main sling, and thus aid in meeting the leg straps coming up from the bottom. Leg straps are adjusted by moving webbing from the double thickness to the single side of the adapter, and vice versa.

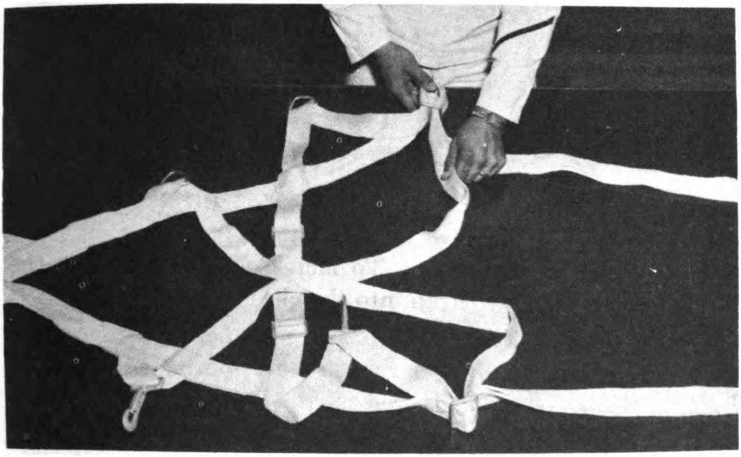


Figure 239. — Passing chest strap into cross-shoulder straps.

The shoulder adapters on the QAC harness are stationary pieces of hardware acting as a securing point for the main sling and as a guide for the body straps. Shoulder adapters of fixed-type harnesses, such as the SS, SB, and TB, are not stationary and may be moved either up or down the main sling. However, the range of adjustment is slight, since these units constitute the suspension points and should be located when possible in the hollow of the wearer's shoulders as shown in figure 240.

Remaining length-adjustments are made with the body straps.

To lengthen a harness, pass webbing from the back-strap into the chest strap and thence into the cross-shoulder straps. A compensating adjustment of the shoulder adapters on FIXED

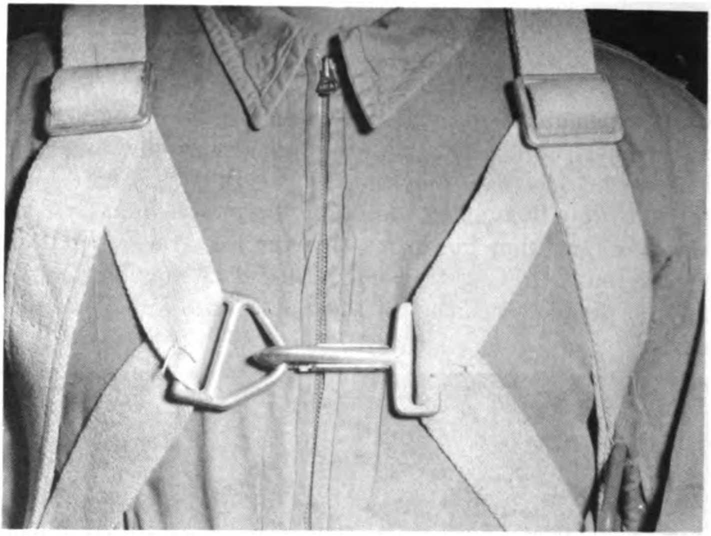


Figure 240. — Position of shoulder adapters on SS parachute.

harnesses may be necessary. To increase the girth, pass the webbing from the back-strap into the chest straps.

The lift webs of SS-type harnesses may be tacked into the container so that the links run to its opposite edge. This shortens the amount of lift-web length from the container to the shoulder adapters.

An oversize harness should be used if moving a portion of the lift webs from the container does not help.

QUICK FIT

In the quick-fit unit, there are four points of adjustment — one on each leg strap and one on each side of the body — located approximately at the lower rib or, in other words, at the lower part of the chest strap. The following illustrations will furnish a complete picture of the adjustment of this type harness.

During flight, the body and leg straps may be loosened for comfort without disengaging the hardware by tilting at right angles to the webbing the snap and "V" ring on the leg straps, and the adapters on the chest straps, and by pulling thereon.

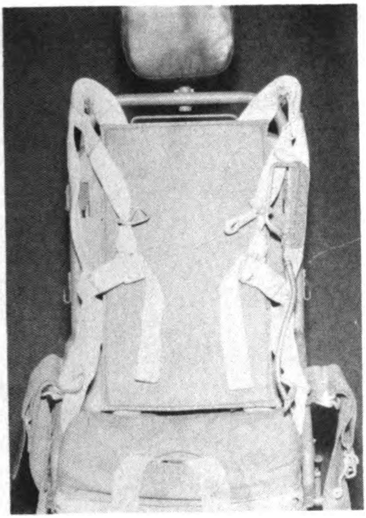


Figure 241. — Quick-fit seat-type parachute ready for use.

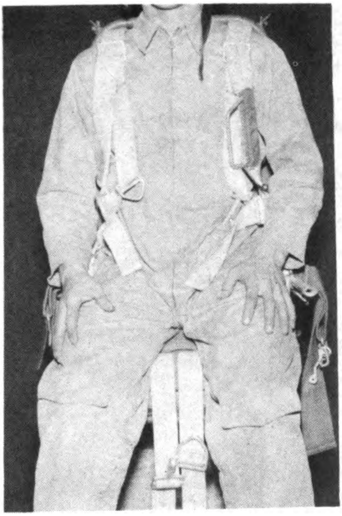


Figure 242. — Quick-fit seat parachute donned but not secured.

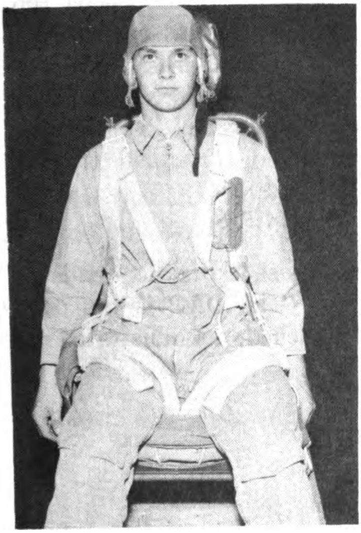


Figure 243. — Quick-fit seat parachute secured but not adjusted.

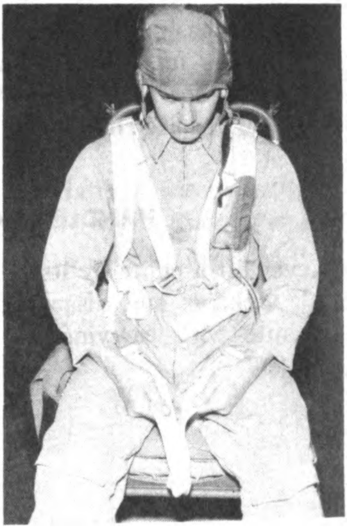


Figure 244. — Quick-fit seat parachute being tightened at leg straps.

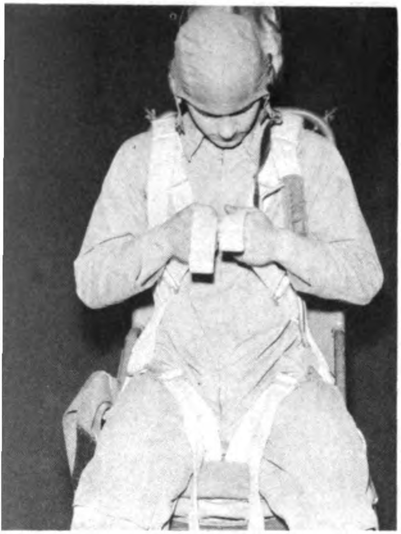


Figure 245. — Tightening body straps on quick-fit seat parachute.

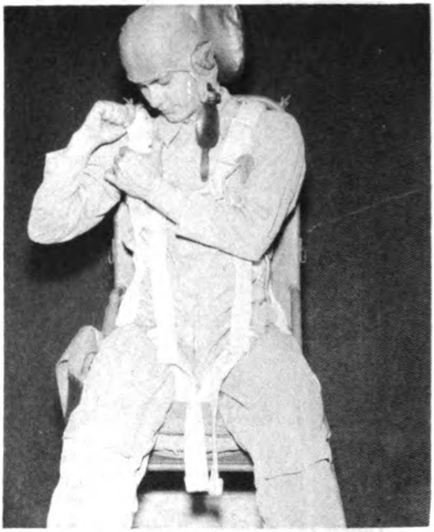


Figure 246. — Adjusted lift webs on quick-fit seat parachute.

Do not unsnap the harness attachments. It cannot be too greatly emphasized that insufficient time exists when an emergency occurs for proper adjustment of the harness prior to bailing out; for this reason, loosening the harness should be held to an absolute minimum.

HANDLING A PARACHUTE

Never lift a chute by its lift webs, as such practice tends to break tackings and disarrange lines. The QAC is the only parachute with carrying handle attached, as illustrated in figure 247.

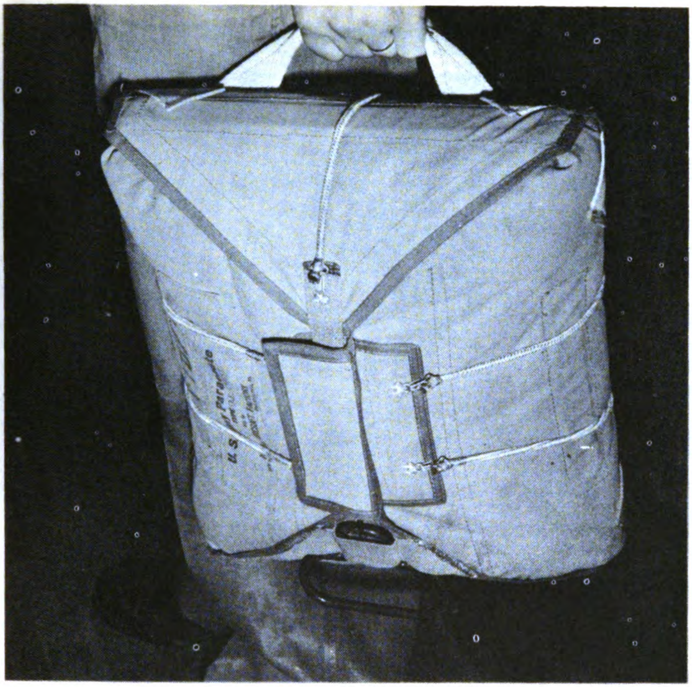


Figure 247. — QAC lifted and borne by carrying handle.

Figures 248–252 demonstrate the proper methods of handling an SS parachute without the raft.

Notice that in all the preceding illustrations, except in figure 252, the pull-handle is guarded against premature opening.

When the SS parachute is rigged with the pararaft, the unit is carried as shown in figure 253.

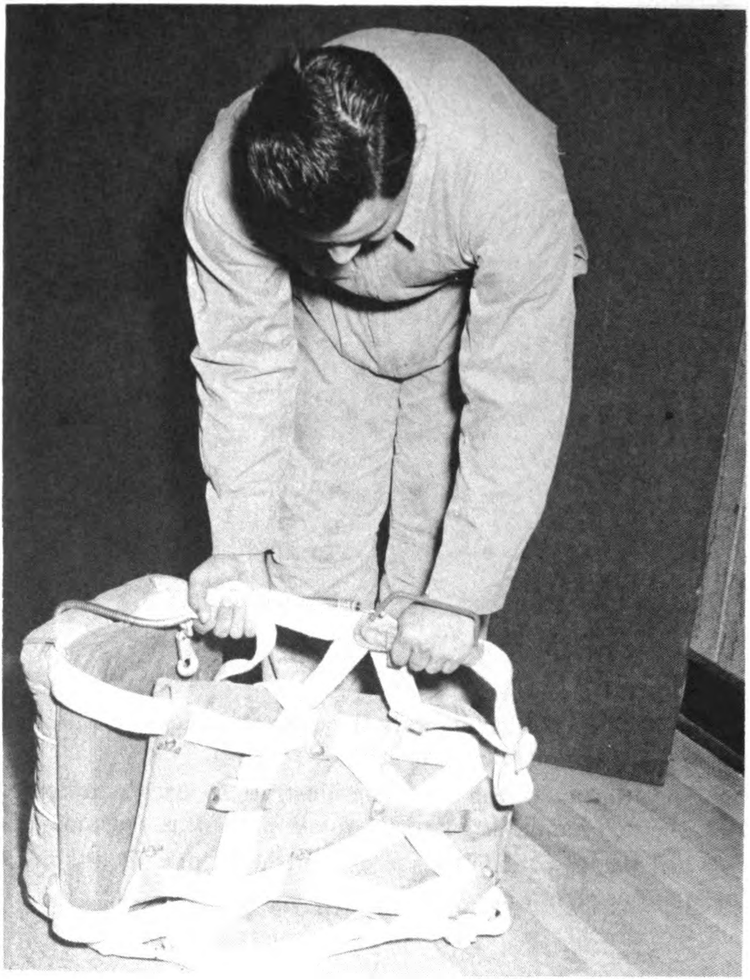


Figure 248. — Method of lifting an SS parachute.

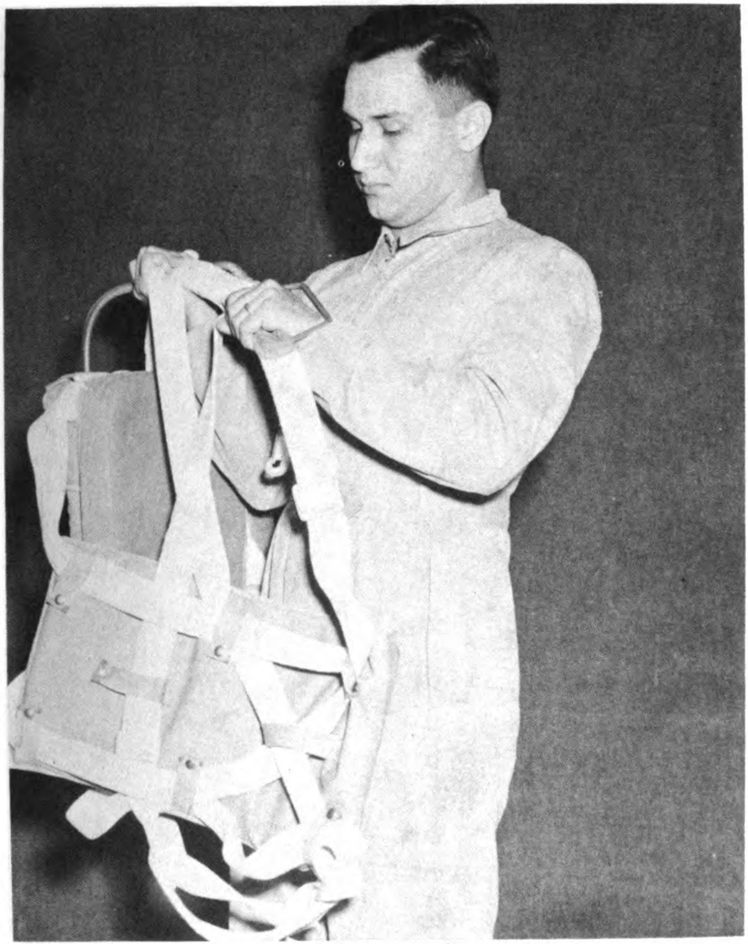


Figure 249. — Lifting parachute to shoulder height.

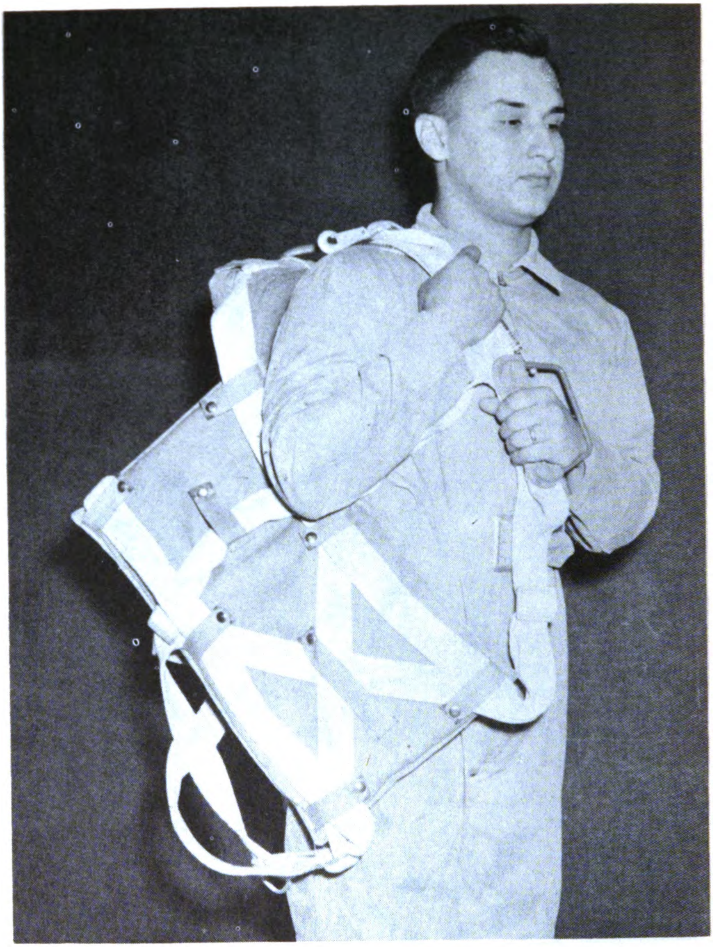


Figure 250. — Carrying parachute on shoulder.

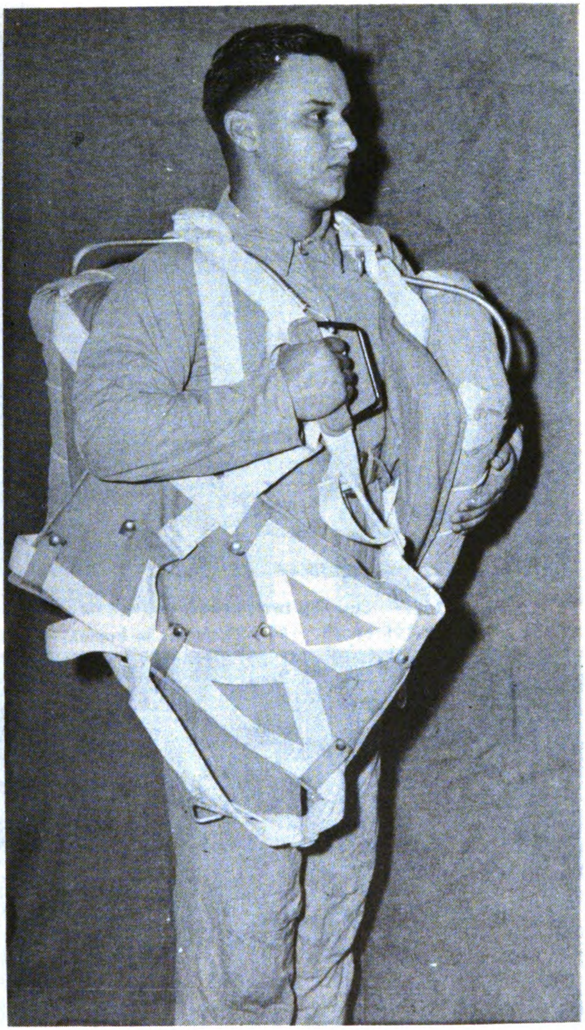


Figure 251. — Carrying two parachutes (front view).

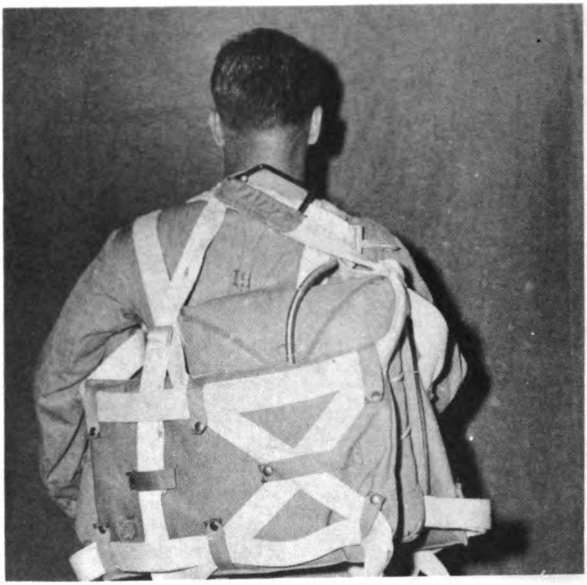


Figure 252. — Carrying two parachutes (rear view).

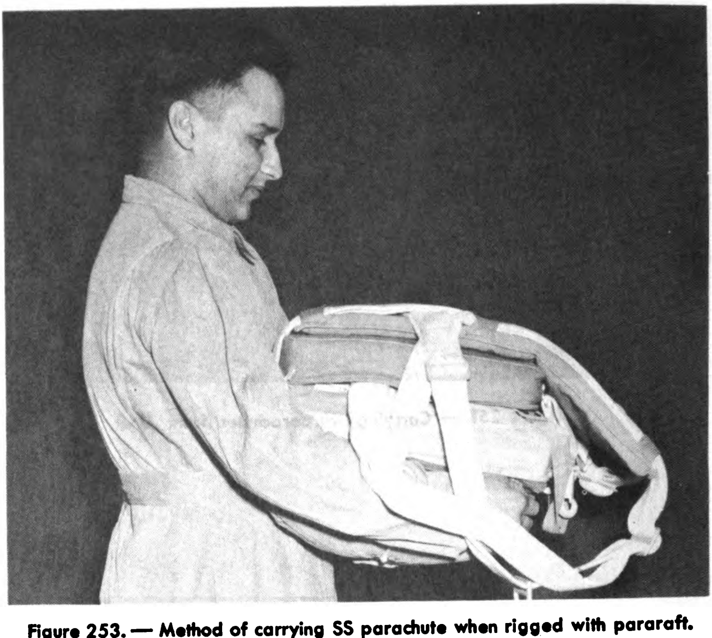


Figure 253. — Method of carrying SS parachute when rigged with pararaft.

Figures 254 to 257, inclusive, illustrate methods of carrying the SB parachute with and without the pararaft.

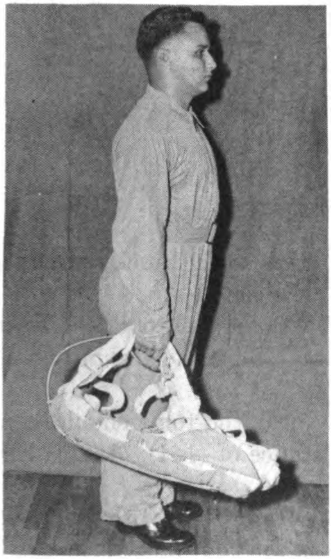


Figure 254.—Method of carrying the SB chute by the harness (without the raft).

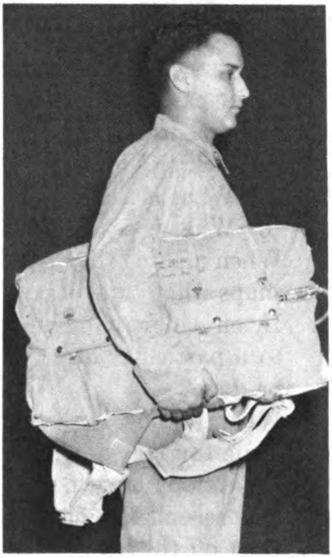


Figure 255.—Method of carrying the SB chute by the pack (without the raft).

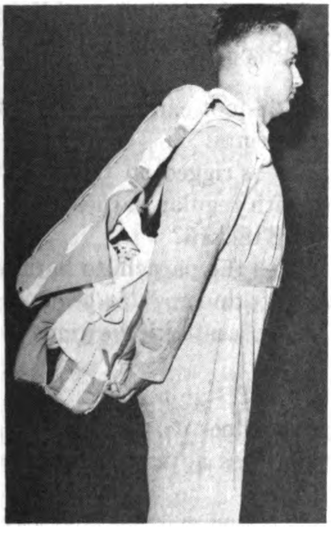


Figure 256.—Method of carrying the SB chute while partially worn (with raft).

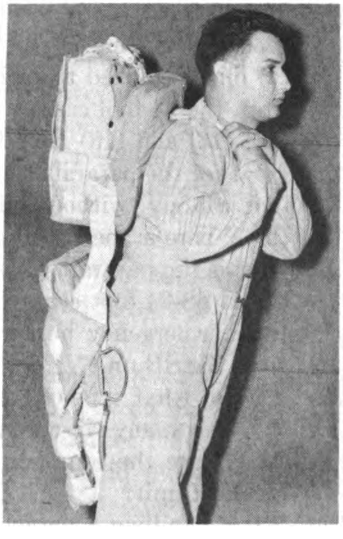


Figure 257.—Method of carrying the SB chute by leg straps and rigged with raft.

QUIZ

1. Describe the use of following packing tools:
    (a) long bar
    (b) fid
    (c) shroud-line hook
    (d) packing cords
    (e) shot bags
    (f) locking pins.
2. (a) What is a dip?
    (b) What is a twist?
3. When making the "break" tackings on the quick connector snaps what type of cord should be used?
4. If, on a new parachute, you discover a shroud line sewn to a particular link which is out of rotation what should be done?
5. When folding the canopy in thirds the folds should continue toward the peak at a distance of (1/4), (1/2), (3/4) the canopy length.
6. The second fold should come to rest (even with the hem) (just off the hem). Give reason for your answer.
7. The force necessary to "crack" the chute should not exceed (15), (18), (22), (24), (27) pounds.
8. The 28-foot canopy has (12), (14), (16), (18) shroud lines, each terminating in (2) (4) (6) (8) links, with (4) (5) (6) (7) lines attached to each link.
9. Both the 24-foot canopy and the 28-foot canopy have (12) (14) (16) and (18) inch diameter vents:
10. How are the pararaft retaining webs rigged on the SS-240 foot canopy (without raft and with regular harness)?
    (b) Where is the rip cord housing tacked?
11. How is the pararaft kit attached to the parachute harness of the SS-24-foot canopy (with raft and regular harness)?
12. In an emergency how may the pararaft kit be removed from the SB unit?
13. (a) For what type of jumps is the TB unit used?
    (b) How many rip-cord assemblies does it have?
14. Where are the four points of harness adjustment on the quick-fit unit?
15. When handling a parachute is it recommended that it be lifted by its lift webs? Give reasons for your answer.

CHAPTER 4

DROP TESTING

DROP TESTING consists of releasing from an aircraft a dummy equipped with a parachute in order to simulate as closely as possible the actual descent of a man-carrying parachute, and to permit checking of design features, operation, and strength of material. If repairs or alterations have been incorporated in the chute, such revisions will be subjected to test.

DROP-TESTING DUMMIES

Figure 258 illustrates, in exploded view, the "formed" rubber drop-testing dummy which has been found particularly suitable for use in testing canopies.

The lead weights, each weighing 25 and 50 pounds, fit inside the dummy. The 50-pound weight has a screw casting in the bottom for securing it in place. The metal leg plate offers protection to that part which otherwise would quickly become damaged in landings. Notice the screw plugs sealing the weights in the arms, legs, and body. It is important that the dummy be solidly packed to prevent shifting of the weights

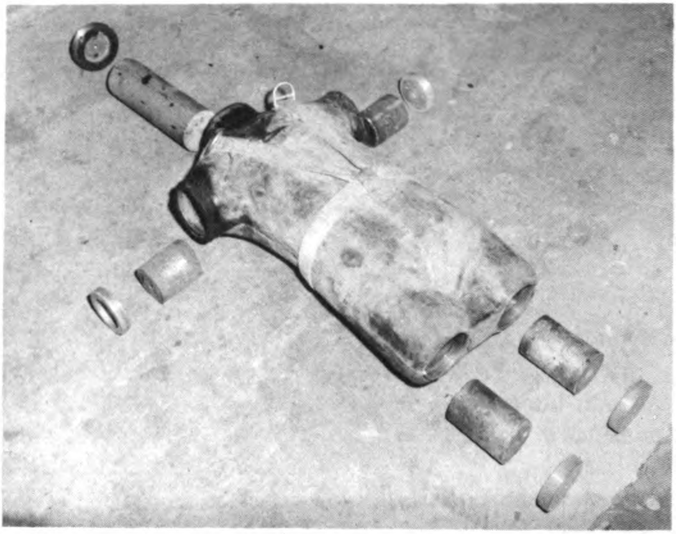


Figure 258. — "Formed" drop-testing dummy.

and consequent damage to the assembly. To maintain a solid non-shifting arrangement any number of wooden blocks may be inserted together with the leads.

The total load capacity of this dummy is 400 pounds.

The BENT-FORMED RUBBER DUMMY, peculiarly adapted for testing harnesses in a drop-test, is shown in figure 259. This dummy is presented in front and side view, and when in use, is loaded with variable lead weights in a manner similar to the FORMED type.

Both these dummies are used for drop-testing parachutes up to speeds of 325 miles per hour. For high-speed drop-testing, a steel drop-testing bomb, developed at NAS, Lakehurst, N. J., has proven highly successful. Figure 260 illustrates this assembly.

The parachute is packed within the cylinder. Due to its construction, the drop-testing bomb need not be carried inside a bomb bay, but may be rigged to a bomb-rack on the underside of wing or fuselage. One of the major safety precaution features of this high-speed unit is the installation of a device which prevents damage to the aircraft in case of premature opening.

As the bomb is released from the plane, the chute is not actually hooked up to the assembly until the bomb has fallen free. The chute hook-up assembly is actuated by an arming wire.

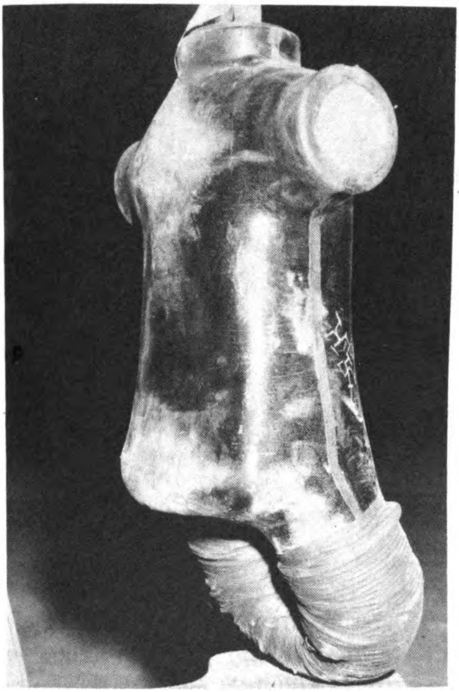


Figure 259. — "Bent-formed" drop-testing dummy.

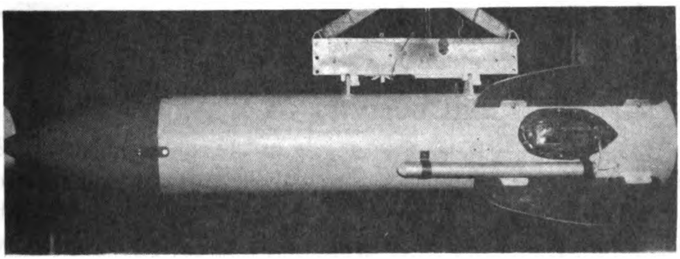


Figure 260. — High-speed drop-test bomb.

RIGGING DUMMIES

Load the dummy to the required weight and attach the bomb rack securing-strap. A 14-inch metal stiffener is placed beneath the webbing securing-strap to keep the hardware properly spaced for rapid connection with the bomb rack. Figure 261 shows the strap and stiffener rigged in place on the dummy.

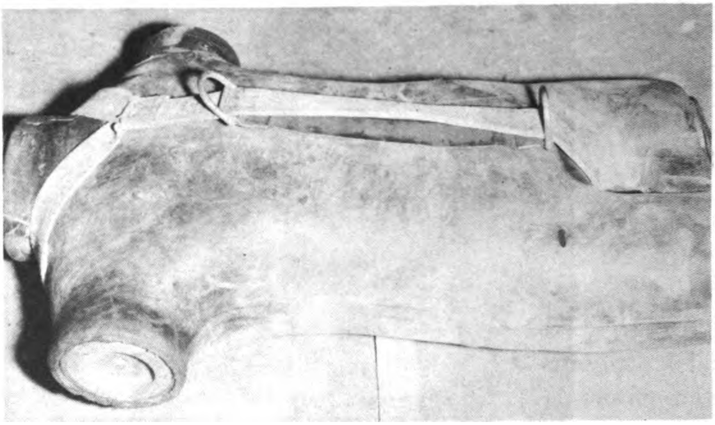


Figure 261.— Drop-testing dummy rigged for bomb rack attachment.

The dummy illustrated is a "formed" type unit rigged with a QAC harness and pack as no other combination is adaptable to this type dummy. Figure 262 shows the "formed" dummy fully rigged for drop and ready for attachment to the aircraft. Notice the QAC which has been modified with a belly-band for greater security.

The "bent-formed" dummy, because of its shape, can be rigged with any type pack. In figure 263, this unit is shown rigged with an SS assembly.

RIGGING DUMMIES TO AIRCRAFT

When a drop-test is to be made at speeds approaching 200 miles per hour, or greater, the dummies are carried in bomb bays or tunnel hatches of appropriate aircraft. Scout bomber planes are particularly adaptable for drop-testing purposes. Figure 264 shows a conventional dummy suspended in a SB2C bomb bay. Notice the position of the pack and static line.

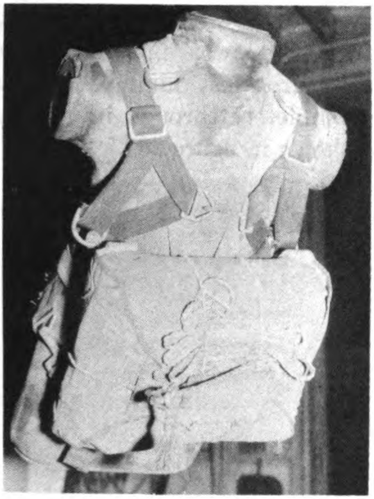


Figure 262. — Fully rigged drop-testing dummy.

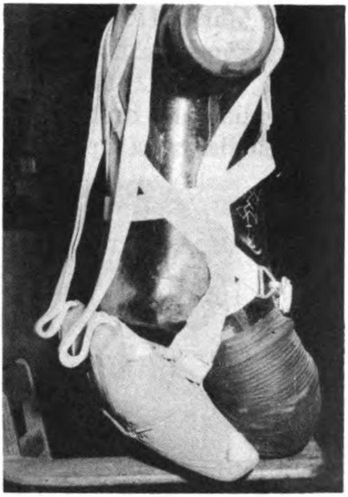


Figure 263.—Bent-formed dummy rigged with SS parachute assembly.

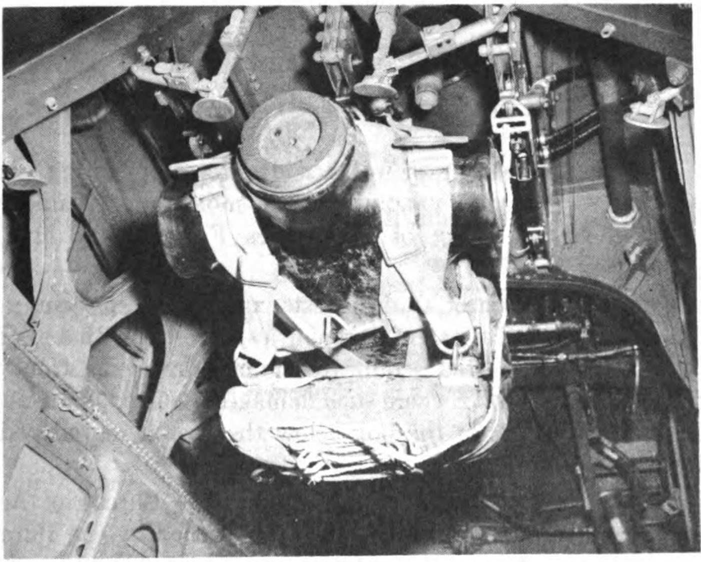


Figure 264. — Fully rigged dummy suspended in bomb bay.

The Mark VII bomb hoist may be used for hoisting extremely heavy dummies, but it is considerably slower than the "mule power" method. Before hoisting a drop-test dummy, it must be modified by drilling a hole completely through its middle for installation of a purchase, as shown in figure 265.

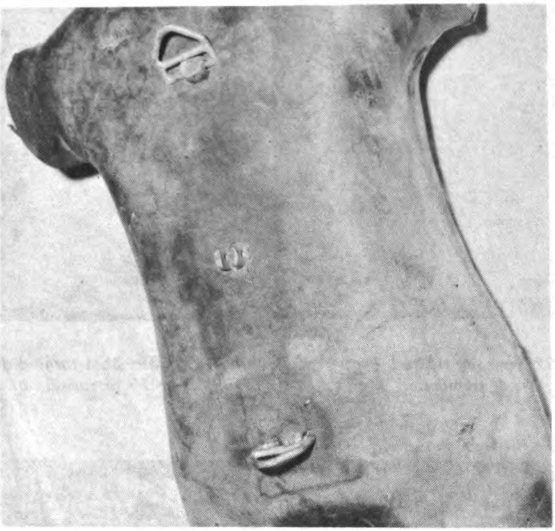


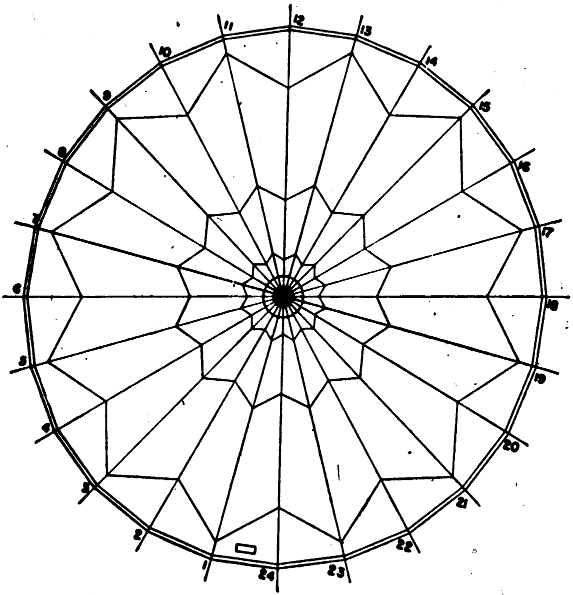
Figure 265. — Drop-testing dummy modified for hoisting.

"Standard" weather, or weather ideal for drop-testing means weather with a WIND VELOCITY of not more than 12 miles per hour, a TEMPERATURE of 59 degrees F., and HUMIDITY of 57 per cent.

Upon completion of all drop tests, a detailed report must be forwarded to the Bureau of Aeronautics, together with a SKETCH OF THE CANOPY tested. Indicate damages resulting from the test, stating EXACTLY where such damages occurred, and supply all data called for in the box below the sketch reproduced in figure 266.

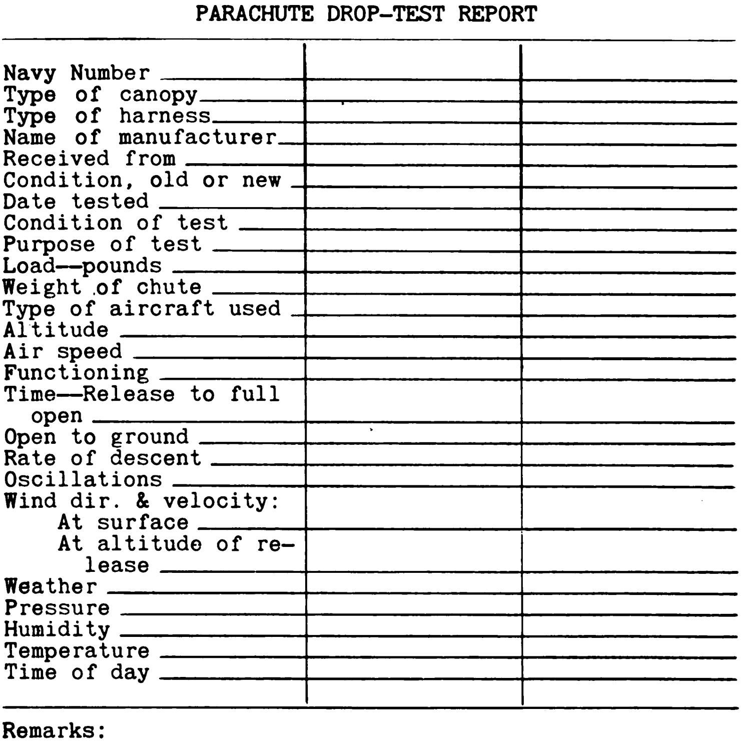
Drop-test specifications are issued by the Bureau of Aeronautics and conducted at a station designated by the Bureau.

Figures 267 and 268 illustrate two types of reports which must be filled out and forwarded to the Bureau with drop-testing reports.



Parachute Number _____	**Red—Ruptures Date Tested** _____
Type _____	**Blue—Cordage Burns**
Mfgr _____	**Green—Seam Separation**
Altitude _____	**Air Speed** _____
Load in Pounds _____	**Test At** _____

Figure 266. — Sketch of canopy used as a drop-test report.

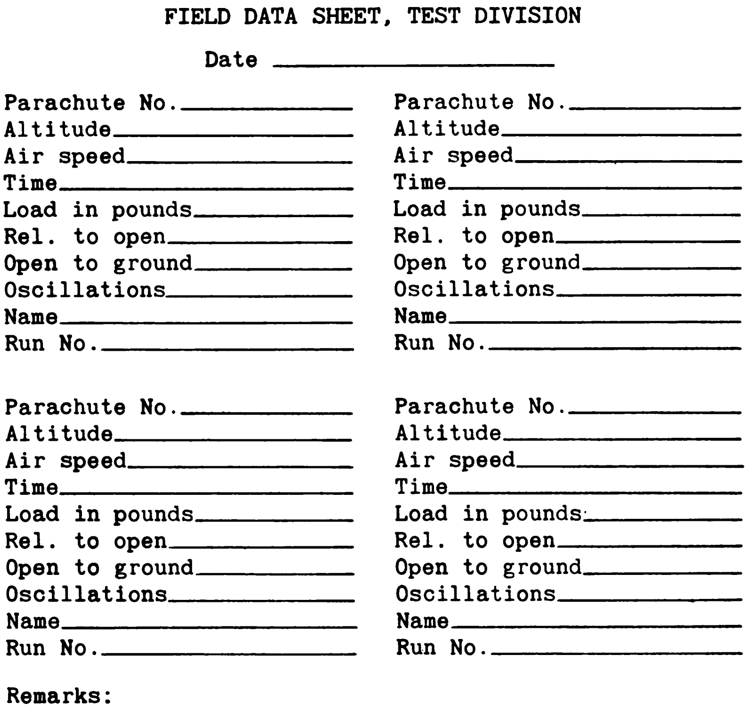


PARACHUTE DROP-TEST REPORT

Navy Number		
Type of canopy		
Type of harness		
Name of manufacturer		
Received from		
Condition, old or new		
Date tested		
Condition of test		
Purpose of test		
Load—pounds		
Weight of chute		
Type of aircraft used		
Altitude		
Air speed		
Functioning		
Time—Release to full open		
Open to ground		
Rate of descent		
Oscillations		
Wind dir. & velocity: At surface		
At altitude of release		
Weather		
Pressure		
Humidity		
Temperature		
Time of day		

Remarks:

Figure 267. — Drop-test report sheet.



FIELD DATA SHEET, TEST DIVISION

Date ____________________

Parachute No. ____________
Altitude ____________
Air speed ____________
Time ____________
Load in pounds ____________
Rel. to open ____________
Open to ground ____________
Oscillations ____________
Name ____________
Run No. ____________

Parachute No. ____________
Altitude ____________
Air speed ____________
Time ____________
Load in pounds ____________
Rel. to open ____________
Open to ground ____________
Oscillations ____________
Name ____________
Run No. ____________

Parachute No. ____________
Altitude ____________
Air speed ____________
Time ____________
Load in pounds ____________
Rel. to open ____________
Open to ground ____________
Oscillations ____________
Name ____________
Run No. ____________

Parachute No. ____________
Altitude ____________
Air speed ____________
Time ____________
Load in pounds ____________
Rel. to open ____________
Open to ground ____________
Oscillations ____________
Name ____________
Run No. ____________

Remarks:

Figure 268. — Drop-test field data sheet.

QUIZ

1. (a) What is meant by drop testing?
   (b) Of what value is it?
2. (a) The weights used in the dummy are (10 and 25 lbs.) (25 and 50 lbs.) (35 and 50 lbs.) (40 and 50 lbs).
   (b) How are the weights in the arms, legs, and body secured?
3. The total load capacity of the dummy is (200) (300) (400) (500) pounds.
4. At what maximum air speed may the bent-formed rubber dummy and the formed type be dropped?
5. (a) Where are dummies usually carried?
   (b) What do we mean by "standard" weather?
   (c) Upon completion of a drop test to what activity must a detailed report be made?
6. Who issues drop–test specifications?

CHAPTER 5

JUMPING

To win your rating, you must understand how to use a parachute. However, before leaving the ground, the parachute you will use must be checked — regardless of whether the chute was packed by yourself or in another loft.

PREMEDITATED DESCENTS

PREMEDITATED or practice jumps may be made only when authorized by the Commanding Officer of the station on which the jump is to take place. All premeditated jumps are made with the TRAINING OUTFIT.

When you stand at the airplane door, ready to jump, grasp the rip-cord handle with your RIGHT HAND. Keep the left hand clear. When the plane is over the jumping area, lean forward with the knees slightly bent, and from this position PUSH YOURSELF FORWARD AND OUTWARD, as in a headlong dive.

Straighten your legs and hold them together to forestall somersaulting. Keep your eye on the plane, and WHEN YOU SEE THAT YOU ARE IN THE CLEAR, PULL THE RIP CORD!

When jumping from low altitudes, securely grip the hand-pull. Do not waste time groping for it. Jerk the handle sharply, pulling the assembly free of the housing, and return your arm close to your body to prevent the outstretched member fouling some part of the chute. When the rip cord is pulled, the parachute takes over in less than two seconds.

You will receive a jolt upon opening shock — and in that moment you will thoroughly appreciate a strong, well-fitting harness. At this point of the jump, you will be uncomfortable; you will be too far forward. To alter position, place your thumbs between the main sling and the sides of your hips and press downward. This pushes the body upward and farther back in the harness. Under no circumstances are the leg straps to be unsnapped.

CONTROLLING THE CHUTE

On the way down, the parachute may oscillate. To check this pendulum-like motion, pull the lift webs DOWN about 18 inches ON THE SIDE TENDING TO RISE. As the direction of oscillation reverses, steady the canopy and decrease the rate of descent by pulling downward on the opposite webs. If you wish to go to the right, pull the lift webs on the right side. This causes the air to spill out of the opposite side of the canopy and imparts a sidewise gliding motion in the direction of the lowered side.

ATTEMPT LANDING WITH YOUR BACK TO THE WIND. Simultaneously PULL TOWARD THE CENTER ON TWO DIAGONAL OPPOSITE LIFT WEBS — the harder the pull the faster you will turn.

Relax as you near the ground, remaining in a seated position and leaning slightly forward in the sling. If your knees are

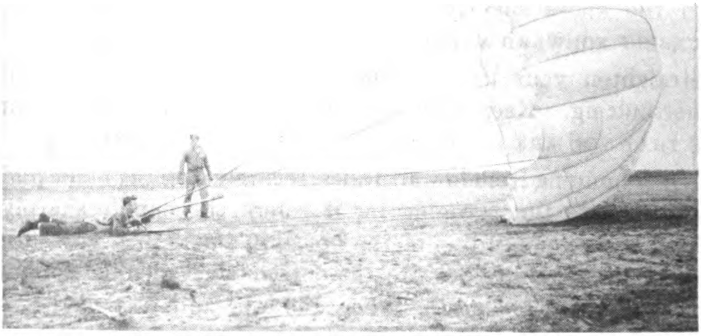


Figure 269. — Collapsing a canopy in a moderate wind.

bent and your feet not more than six inches apart, you will be ready for the landing shock. When you touch the ground, fall, if possible, into the direction of the wind, and immediately go into a tumble. Never try to maintain an erect position or to resist the tendency to fall or roll.

The parachute is collapsed by pulling on several of the shroud lines — those nearest the ground toward you. The correct method of collapsing a chute is pictured in figure 269.

When the parachute has been completely collapsed, remove the harness.

You will strike the earth with greater impact when landing on a sandy beach or desert. The rate of descent over sand is faster because of the fewer upward air currents.

Greater currents of air exist over marshes, and consequently you may expect a slower rate of descent and a softer landing.

Considerable changes exist in the air during the course of one day. During the middle of the day, for example, while the sun is warmest, descent will be faster than the average 19 feet per second. At night and in the early morning, descent will be slow. Veterans claim that the best time for jumping is under a full moon.

If landing in trees seems inevitable, MAKE YOURSELF SMALL so that contact between your body and the trees will be as little as possible. Keep your body in an upright position with feet tightly together and knees slightly bent. Place arms over your face. Never grasp the limbs of a tree, but allow the canopy and shrouds to catch in the branches. The lines will support your body.

LANDING IN A HIGH WIND

One method of avoiding being dragged along the ground by a high wind after landing is to collapse the canopy, but in case the wind velocity exceeds 50 knots and you cannot collapse the chute, GET OUT OF THE HARNESS.

To prepare for releasing the harness, sit well back in the sling. Unfasten the snap hooks of leg straps and see that they fall free, then unfasten the chest straps. Do NOT REMOVE YOUR ARMS FROM THE SHOULDER STRAPS. To make certain that you remain in the harness until ready to leave, fold your arms across your chest. Just before releasing the harness, grasp the after lift webs with both hands and with arms bent. The instant you touch the ground, release the lift webs and RAISE YOUR ARMS to the back of your head, at the same time sliding free of the harness and going into a tumble.

WATER LANDINGS

After the chute opens, the jumper will probably be resting his weight forward on the harness leg straps. An attempt should immediately be made to get the buttocks back into the harness sling in preparation for the water landing.

With the body weight thus removed from the leg straps to the harness sling, the jumper should release both leg straps and the chest snap while keeping his arms around the harness sling and crossed in front. When the chest snap is released during descent, the main sling tends to separate to form a more perfect "V."

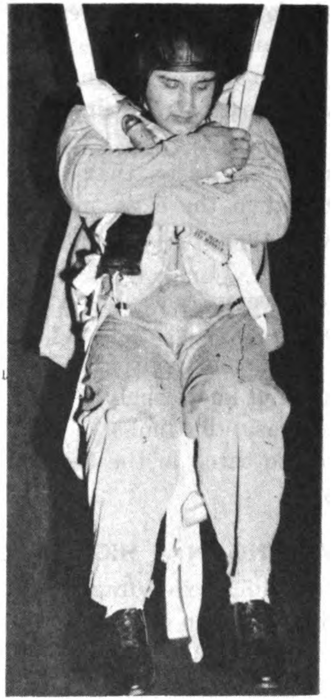


Figure 270. — Ready for the plunge!

After releasing the leg and chest snaps, the life-vest toggles, knife, and pararaft lanyard should be checked for readiness. Figure 270 shows the jumper well back in the sling and ready for a water landing with chest and leg straps unfastened.

Releasing the harness snaps in the air is considered highly advisable if the surface wind is in excess of 15 knots and white caps are visible on the water. If time does not permit the jumper to get his weight from the leg straps and release all harness snaps, the chest snap ONLY should be released to permit instantaneous inflation of the life vest on contacting the water.

In riding into the water while seated in the harness sling, the jumper will submerge two or three feet. The life vest should then be inflated, and the jumper should free himself from the harness, retaining a hold on the webbing. Upon surfacing, which is rapid, the jumper should seek to deflate the canopy by pulling in the upper shroud lines.

The pararaft lanyard was designed for securing the equipment to the wearer as well as for acting as a guide in locating the raft cylinder after contact with the water.

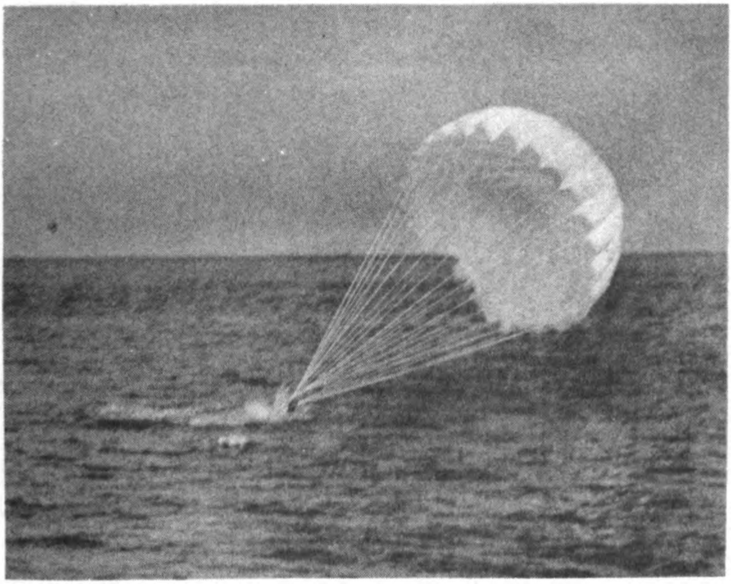


Figure 271. — Jumper landing in the water.

After deflating the chute, the jumper should swim to windward with the pararaft kit released from its container, keeping the pararaft and survival gear between himself and the chute to avoid entanglement. When the raft has been broken out and inflated, it is desirable to secure the harness and chute to the large end of the raft to facilitate boarding.

The jumper should not attempt freeing himself of the harness until he is in the water. Figures 271, 272, and 273 illustrate the major stages of a water jump.

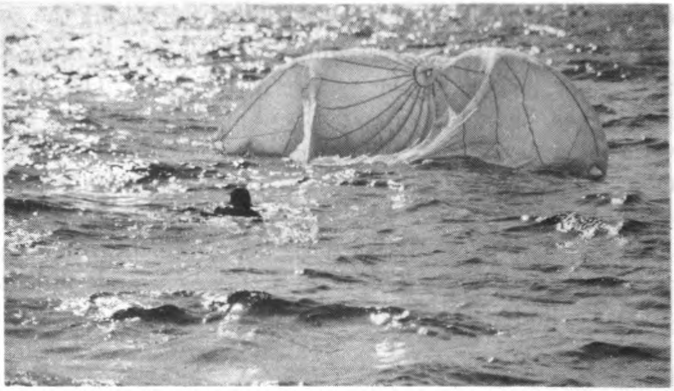


Figure 272. — Deflating the canopy.

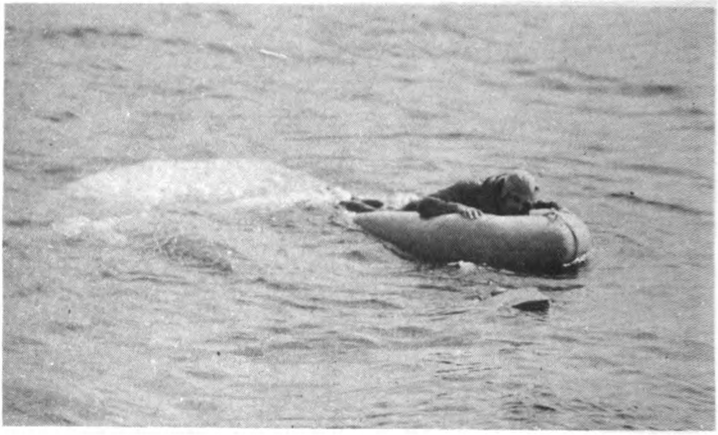


Figure 273. — Boarding the pararaft.

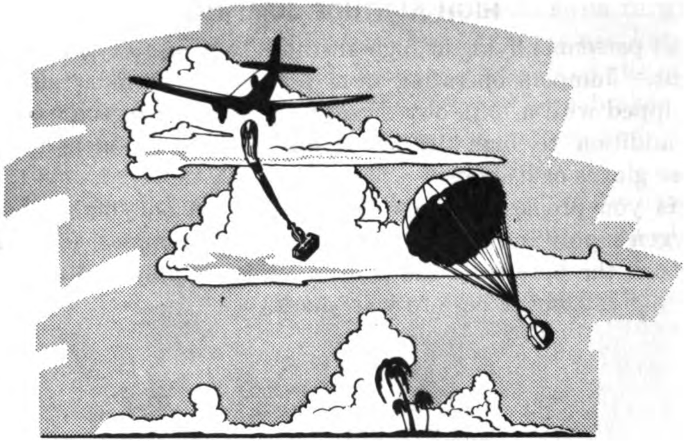
HIGH-ALTITUDE JUMPING

All personnel flying at high altitudes MUST use oxygen equipment. Jumpers operating from high altitudes must also be equipped with a BAIL-OUT OXYGEN BOTTLE and OXYGEN MASK, in addition to high-altitude flying gear which includes NO loose gloves or helmets.

As you prepare to leave the plane, turn on your bail-out oxygen supply and check to see that it is operating satisfactorily. Detach the hose from the plane's oxygen supply and connect the bail-out bottle hose to your mask.

QUIZ

1. Who authorizes premeditated or practice jumps?
2. (a) If you wish to go to the left while coming down in your parachute what would you do?
   (b) When you strike the ground fall (away from) (into) the direction of the wind.
   (c) To collapse the parachute after you have landed pull on the shroud lines (nearest) (farthest) from the ground.
3. What is the first thing you should do when you touch the ground if you are landing in a high wind?
4. After making a water landing how may the canopy be deflated?
5. When flying at high altitudes what oxygen equipment must a jumper be equipped with?



CHAPTER 6

AERIAL DELIVERY

Types of aerial delivery vary widely. Sometimes supplies or equipment have to be dropped to men in an open boat at sea; sometimes supplies must be lowered to men marooned on an island, in a jungle, or in mountainous regions; other times equipment must be dropped behind enemy lines. Conditions and circumstances determine the kind of equipment to be dropped and the types of assemblies to be used.

Since the Army is best equipped for aerial delivery, a description of Army equipment will be included here. Items of aerial delivery equipment originated by the Army Air Forces may be drawn through Naval Aviation Standard Stock. Refer to your ASO catalog for available lists and restrictions.

An aerial delivery parachute is one used for dropping loads of supplies and equipment from aircraft. The **Type G-1 Aerial Delivery Parachute** is used in conjunction with various containers, cartons, packs, and slings designed especially for handling and enclosing the supplies and equipment most likely to be delivered by air. This chute is made up of a 24-foot canopy, a lift-web assembly, and a pack containing two parts, body and cover. The load capacity is 300 pounds maximum at 150 miles per hour.

CANOPY

The canopy is constructed of four-ounce rayon fabric and made up in 24 gores cut in one piece. Vent and skirt hems are reinforced with rayon tape. The parachute is opened by means of a static line attached to the airplane and to the parachute. When the load is released, the static line becomes taut, opening the pack to pull out the parachute. A break cord releases the chute from the static line for free descent.

PACK

The pack body (bottom part) is reinforced with plywood enclosed between two layers of duck, furnishing rigidity to the body and making packing and handling much easier. On the bottom of the body, near the left and right edges, are two rows of webbing hesitator loops. In the side wall of the pack body is a row of brass grommets to which the cover is laced. At each outer corner are located a pair of tapes for attachment of the pack body to the load container provided for use with this parachute assembly. Figure 274 illustrates the general construction of the pack body.

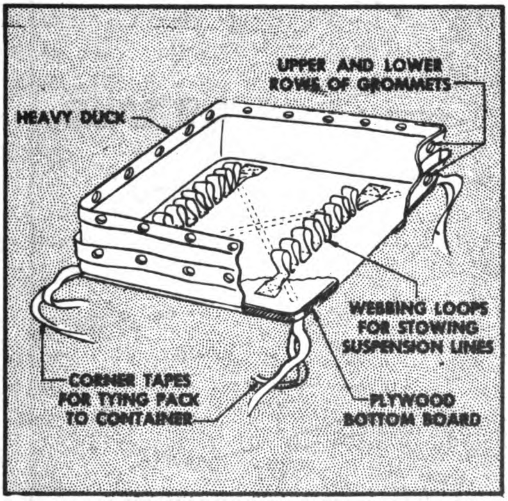

UPPER AND LOWER ROWS OF GROMMETS
HEAVY DUCK
WEBBING LOOPS FOR STOWING SUSPENSION LINES
CORNER TAPES FOR TYING PACK TO CONTAINER
PLYWOOD BOTTOM BOARD

Figure 274. — Pack body.

The pack cover, illustrated in figure 275, is reinforced with two strips of heavy webbing extending across the top and down the sides. These strips cross each other directly beneath an opening in the center of the top, and at this point, the static line is looped about them. When the static line is drawn taut by the dropping of the load, the strain is transmitted to these webbing strips which in turn snap the pack lacings, causing the pack to open and release the chute. Around the lower edge of the pack cover is a row of grommets spaced to coincide exactly with the grommets in the body. When the pack is laced, these grommets come together, and the lacing cord passes freely through them.

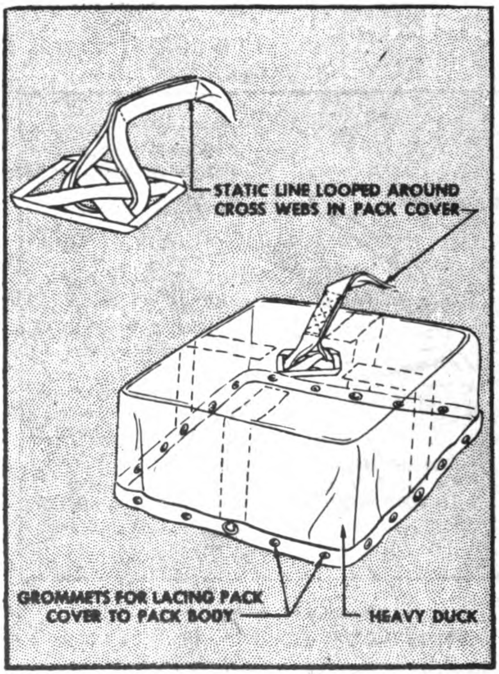

STATIC LINE LOOPED AROUND CROSS WEBS IN PACK COVER
GROMMETS FOR LACING PACK COVER TO PACK BODY
HEAVY DUCK

Figure 275. — Pack cover.

The pack assembly is pictured in figure 276.

The following steps and illustrations describe the packing procedure for this parachute.

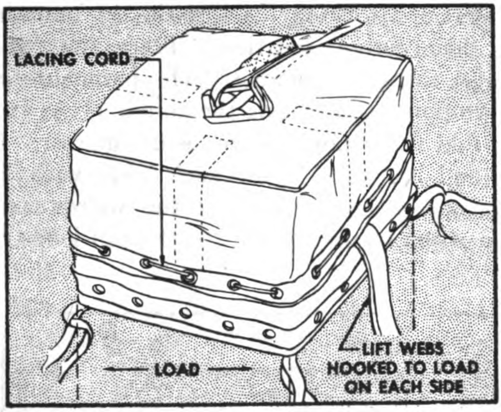


Figure 276. — Pack assembly.

Place the connector loops at the end of the suspension lines over the tension device in the surface of the table, and draw the parachute taut. Divide the suspension lines into two groups of 12 lines each; grasp each group, and work toward the skirt of the chute to separate the lines while dividing the gores into two groups according to the respective suspension lines.

Thus arranged, the top center gore, between lines NUMBER ONE and NUMBER *24*, should be on top, and the bottom gore between lines NUMBER *12* and *13* should be on the bottom, as shown in figure 277. Lines NUMBER ONE to *12*, inclusive, will be in the left-hand group, and NUMBERS *13* to *24*, inclusive, in the right-hand group. Next, trace suspension lines ONE and

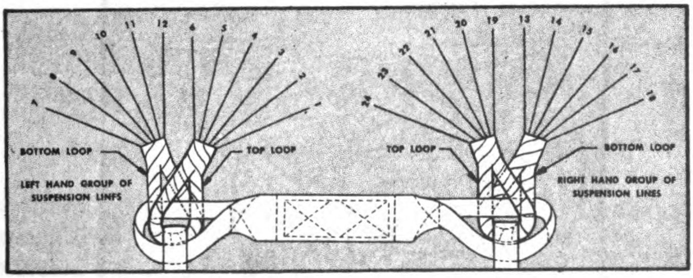


Figure 277. — Position of connector loops and suspension lines when ready for packing.

24 from the skirt of the canopy back to the top connector loops, ascertaining their correct location. Trace the two inboard bottom lines in the same manner. The parachute is now in position for whipping and folding the gores.

Whip and fold the canopy in the usual manner. Place the safety strap and lift webs in the pack body with the safety strap extending across one end between the two rows of hesitator loops in the bottom of the pack. Tie the end loops of the lift

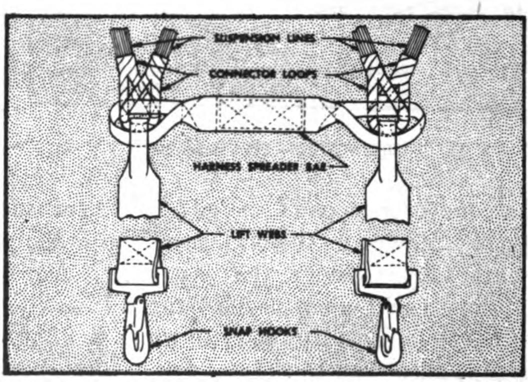


Figure 278. — Safety strap connector loops and lift webs.

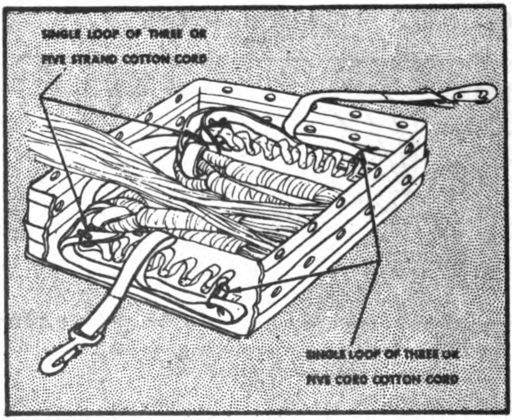


Figure 279. — Lift-web position in all packs except for use with containers A-4, A-5, and A-9.

webs to the end hesitator loop on either side with one turn of 5-cord cotton. Lay the lift webs along each side of the pack, between the side wall and the row of hesitator loops. Figure 278 shows parts of the lift-web assembly.

Bring the lift webs along the full length of the side, fold them over, then bring the remaining length out over the edge of the pack at the middle of the side, as demonstrated in figure 279. Tie the folded end to the last hesitator loop with 5-cord cotton.

When packing an assembly for use with aerial delivery container A-4, A-5, or A-9, one lift web is handled as previously described; the other is brought across the lift web safety strap as shown in figure 280. The position of the connector rings on the A-4, A-5, and A-9 containers require that both lift webs emerge from the pack on the same side, one extending about 15 inches farther than the other.

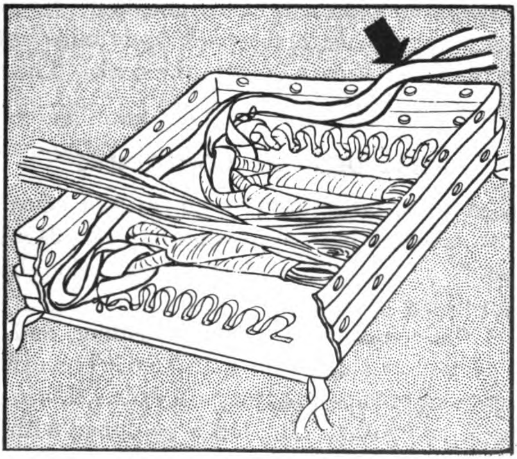


Figure 280. — Lift-web position for containers A-4, A-5 and A-9.

Make certain that the tongue-sides of the snap hooks face DOWNWARD, or it may prove impossible to hook the assembly to the aerial delivery container.

Next, stow the suspension lines, beginning with the second loop from the end.

Place the skirt of the canopy over the folded lines and fold the remainder of the canopy on top of the skirt in conventional accordion pleats, the apex being the top fold.

Now connect the static line to the canopy as follows:

With 450-pound webbing or tape, make a loop about six inches in length by passing the webbing under all suspension lines in the apex of the canopy. Tie the loop with a square knot, then fashion an overhand knot on each end of the webbing to prevent slipping. This loop is then secured to the static line with one turn of 100-pound cotton cord or three turns of 5-cord cotton. This is the BREAK CORD.

Draw the pack cover down over the canopy and pack body and lace the body and cover together by passing a double thickness of five-strand cotton through the grommets. Tie this cord securely with a surgeon's knot, a square knot, and a series of overhand knots.

Push the lift webs beneath the pack-cover edge until about ten inches of webbing remain outside the pack. The assembly is now ready for use.

AERIAL DELIVERY CONTAINERS

The TYPE A-4 AERIAL DELIVERY CONTAINER consists of an adjustable canvas container, approximately 12 x 24 x 30 inches in size when fully loaded. It has a suspension harness of webbing sewn to the canvas body.

One end of the container is open for loading, and is closed by means of flaps laced together with cord. The other end is equipped with sets of tape for tying up excess fabric after the container has been loaded. The top is equipped with webbing straps and "V" rings for attachment to the parachute, and is reinforced with a steel frame containing two steel loops for engaging the bomb shackle. The bottom is reinforced with plywood. The container is furnished with two corrugated fiber boxes, specification number LLL-B-631, Style 1, Board Number 5, about 12 x 17 x 30 inches in size. It may be used with or without such boxes.

PACKING AND ASSEMBLING

When the container is packed with supplies, the weight of the contents should not exceed 200 pounds.

Figure 281 illustrates the construction of the A-4 container. Note that there are two sets of connections on the top — a pair of steel loops for engaging the bomb shackle and a pair of web straps with "V" rings for attachment to the parachute.

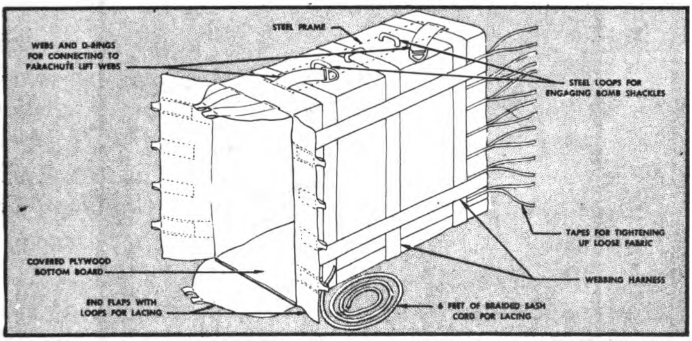

STEEL FRAME
WEBS AND D-RINGS FOR CONNECTING TO PARACHUTE LIFT WEBS
STEEL LOOPS FOR ENGAGING BOMB SHACKLES
TAPES FOR TIGHTENING UP LOOSE FABRIC
COVERED PLYWOOD BOTTOM BOARD
WEBBING HARNESS
END FLAPS WITH LOOPS FOR LACING
6 FEET OF BRAIDED SASH CORD FOR LACING

Figure 281. — Type A-4 aerial delivery container assembly.

When the container is loaded close the open end by lacing with the six-foot length of braided sash cord furnished with the container.

Tighten the excess fabric by tying together the pairs of webbing tapes at the other end of the container. The parachute assembly is tied to the end of the container, and the tie-tapes of the chute pack are passed around the container harness-webbing.

Snap the lift webs of the parachute to the "V" rings on the web straps at the top of the container. To prevent the lift webs from pulling out of the pack under slip-stream pressure, tack them to the webbing with one turn of doubled No. 30 x 3 thread. A standard 15-foot static line is used, the excess line is secured by folding and tying with one turn of 5-cord.

TYPE A-5 CONTAINER

The Type *A-5* aerial delivery container consists of a heavy sheet of canvas, 15 feet long by 56 inches wide, with a pad of felt 40 inches wide running down the center. The canvas edges fold inward over the load, and the unit is rolled up from a roll about 18 inches in diameter over which removable end caps are fitted. It is used in conjunction with the standard aerial delivery parachute, Type G-1. The Type A-5 container was developed for the aerial delivery of rifles and similar equipment and supplies.

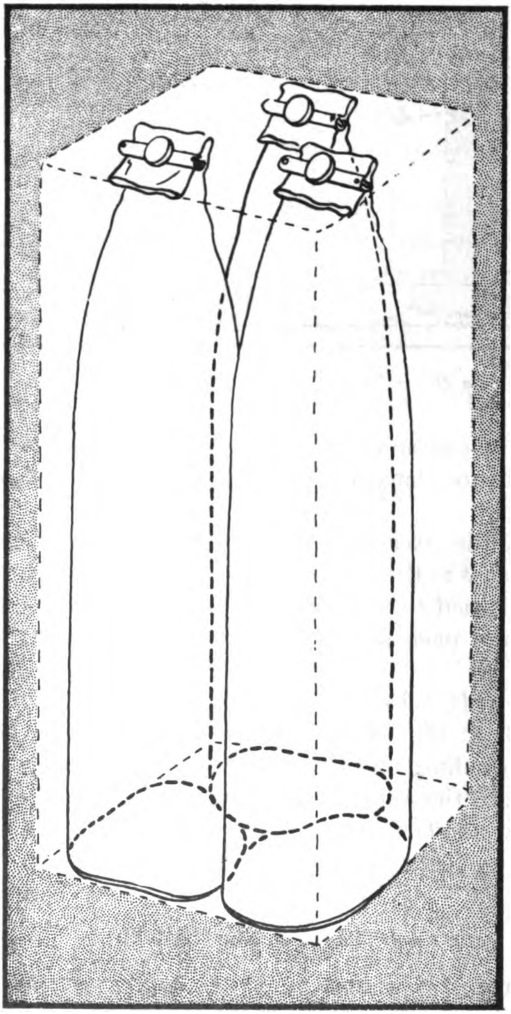


Figure 282. — Three plastic water bags packed in the A-6 container.

Lay the container roll flat, with the rifles placed about 12 inches apart upon it, butts alternating at the outer ends. The container will accommodate about twelve Model 1903 or Model M-1 rifles to a roll. Spaces between rifles are filled with ammunition.

Fold the canvas flaps at the edges over the ends of the rifles, and roll the container about the guns to make a compact roll. Draw end caps over the ends of the roll and secure by fastening adjustable webbings together, using bayonet fittings or snap hooks. Tighten the webbings to suit the load.

Attach the parachute to either end of the container by tying the tapes on the corners of the pack to the tabs on the end of the container cap.

Hook the lift webs of the parachute to the "V" rings and tack the webs to the edge of the end cap, using one turn of doubled No. 30 x 3 cotton thread.

TYPE A-6 CONTAINER

The TYPE *A-6* AERIAL DELIVERY CONTAINER consists of four parts — a corrugated fiber carton into which the contents are packed, a canvas cover fitting over and protecting the carton, a webbing sling or harness for suspending the container to the parachute assembly, and a shock-absorbing pad attached to the bottom of the completed unit.

This container is used in conjunction with the standard aerial delivery parachute Type G-1, for the delivery of miscellaneous supplies and equipment. The dimensions of the corrugated fiber carton are 12 x 12 x 30 inches, Specification Number LLL-B-631, Style 1, Board Number 5.

Figure 282 shows the three plastic water bags packed in the A-6 container.

THE A-7 CONTAINER

The TYPE *A-7* AERIAL DELIVERY CONTAINER consists of an adjustable webbing sling developed specifically for use in delivering 30, 45, and 50 caliber arms and 37-mm ammunition. However, since this sling is adjustable, it can readily be adapted for the delivery of other equipment and supplies, including standard five-gallon cans for water and other liquids. The Type A-7 container is used in conjunction with the standard aerial delivery parachute, Type G-1. The unit is illustrated in figure 283.

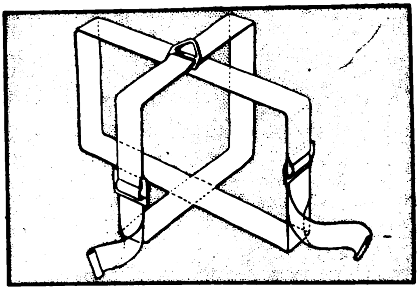


Figure 283. — A-7 container adjustable webbing sling.

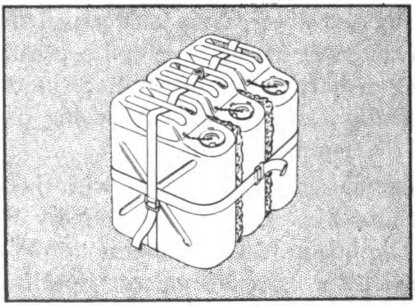


Figure 284. — A-7 sling applied to three five-gallon cans.

The webbing sling shown is strapped around the standard ammunition box or other load with the "V" ring on top and drawn taut.

When the sling is used with three standard five-gallon cans, a pad should be inserted between the cans as described in figure 284.

Attach the chute assembly on either side the load by tying the tapes on parachute-pack corners to the webbings on top and bottom of the load. Hook the lift webs of the chute to the "V" ring on top of the sling.

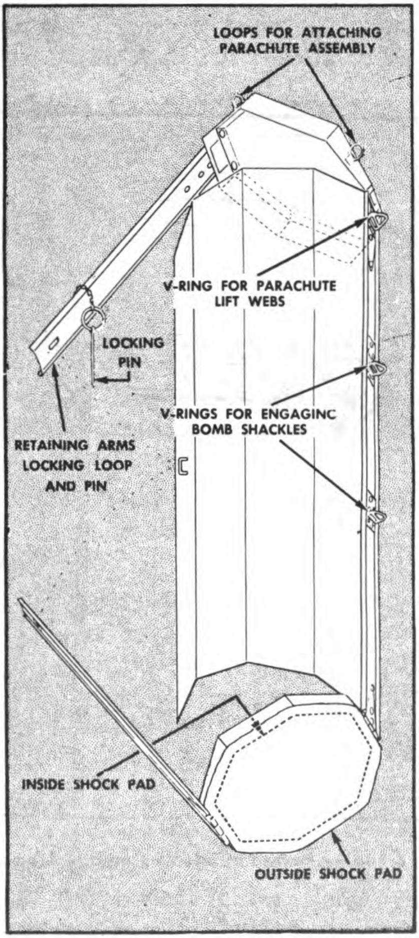

LOOPS FOR ATTACHING PARACHUTE ASSEMBLY
V-RING FOR PARACHUTE LIFT WEBS
LOCKING PIN
V-RINGS FOR ENGAGINC BOMB SHACKLES
RETAINING ARMS LOCKING LOOP AND PIN
INSIDE SHOCK PAD
OUTSIDE SHOCK PAD

Figure 285. — A-8 aerial delivery container.

TYPE A-8 CONTAINER

The *A-8* AERIAL DELIVERY CONTAINER consists of a rigid, octagonal-shaped, collapsible container constructed of reinforced fiber-board 50 inches long by 18 inches in diameter. It is intended for delivery of rifles, and is used with the Type G-1 parachute (see figure 285).

Figure 286 illustrates the method of attaching the chute to the container.

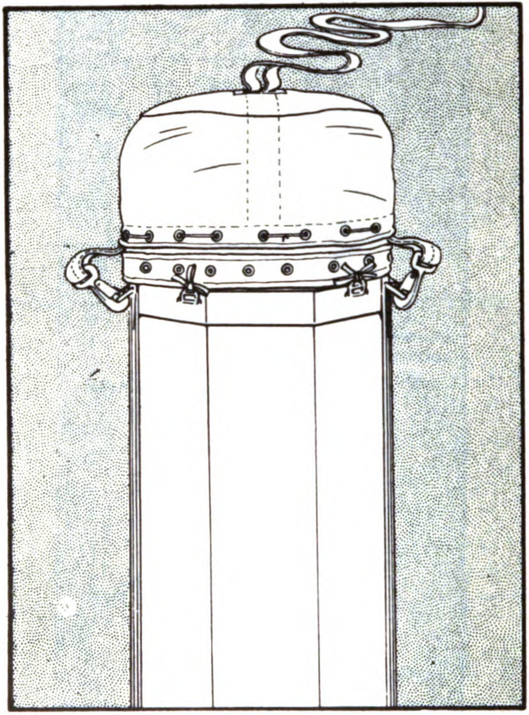


Figure 286. — Method of attaching parachute assembly.

THE A-9 CONTAINER

The TYPE *A-9* AERIAL DELIVERY CONTAINER consists of an adjustable webbing sling developed for the aerial delivery of 60, 75, and 81 mm fiber ammunition cases, and is used in conjunction with the standard aerial delivery parachute, Type G-1.

TYPE A-10 CONTAINER

The *A-10* AERIAL DELIVERY CONTAINER consists of a cargo net approximately nine feet square. It is intended for delivery of miscellaneous equipment of suitable size and is used in conjunction with the standard aerial delivery parachute, Type G-1.

TYPE A-3 CONTAINER

The TYPE *A-3* AERIAL DELIVERY CONTAINER consists of a five-gallon capacity metal can with a canvas covering extending beyond the top of the can to form a holder for the parachute canopy.

The extension of the canvas covering beyond the bottom of the can provides a pocket for a landing-shock-absorbing pad. A pack cover is provided to fit over the parachute pack, and to this cover a rope static line is attached. The bottom of the canvas covering is closed by means of a 50-foot rope weighted with a five-pound sand bag. This weighted rope uncoils during the drop but remains attached to the bottom of the unit for retrieving in the event of tree landings.

When the container is filled, the canvas cover is drawn completely over the can and the shock-absorbing pad is placed under the bottom.

Close the bottom of the canvas cover by lacing the free end of the 50-foot drop-line through the grommets and drawing up taut. Fasten with a bowline knot. The canopy is made ready for packing by whipping and folding in the usual manner. Attach one group of lines to each of the four webbing loops.

Lay the suspension lines in folds on the sewed-in canvas flap forming the bottom of the parachute-pack portion of the canvas cover. The folded canopy is laid in accordion-folds on top of the suspension lines.

Tie a 100-pound cord about 12 inches in length to the webbing loop inside the pack cover. Tie the free end of the pilot chute connector cord from which the pilot chute has been removed, to the 100-pound cord loop, using a bowline knot.

Tie the loose end of the sand bag to the top webbing loop aligned with the D-rings on the outside of the container cover by passing a single turn of five-strand cord through the grommet in the sand bag, through the webbing loop, and thence through the loop inside the pack cover, as shown in figure 287.

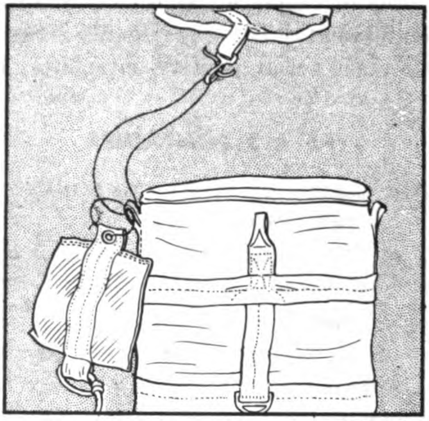


Figure 287. — A-3 container break cord tied to sand bag, pack and pack cover.

Tie the sand-bag rope to the webbing at each end of the D-ring, using one turn of five-strand cord. Coil the remainder of this rope and tie to the bottom of the assembly.

Pull the pack cover down over the assembly and fasten by threading one turn of 50-pound cord through the webbing loops on the pack cover and through the second row of webbing loops on the container cover.

LAUNCHING INSTRUCTIONS AND RESTRICTIONS FOR AERIAL DELIVERY CONTAINERS, TYPES A-4, A-5, A-6, A-7, A-8, A-9, A-10 AND A-3

To reduce as much as possible the risk of damage to the loads, aerial delivery containers should be dropped at a maximum speed of 150 miles per hour, and at a minimum altitude of 300 feet.

All containers of this type can be manually launched from openings in the fuselage. When so launched, the entire 15 feet of static line is utilized.

All aerial delivery containe s, excepting Types A-7 and A-10, can be launched from internal or external bomb racks. When launched from internal bomb racks, the full 15 feet of static line is used. When launched from external bomb racks, the static line is shortened to 10 feet by winding the line around the bomb shackle attachment so that it does not interfere with the launching mechanism.

Containers A-5 and A-9 are equipped with D-rings for engaging bomb shackles. These containers can be launched from bomb racks when the dimensions of the load are such that these D-rings are spaced to fit standard bomb shackles. It is absolutely essential that the free end of the static line be attached to some structural member of the airplane.

The rate of descent of the standard aerial delivery parachute, Type G-1, is illustrated in a graph in figure 288. The launching of this chute is illustrated in figures 289, 290, and 291.

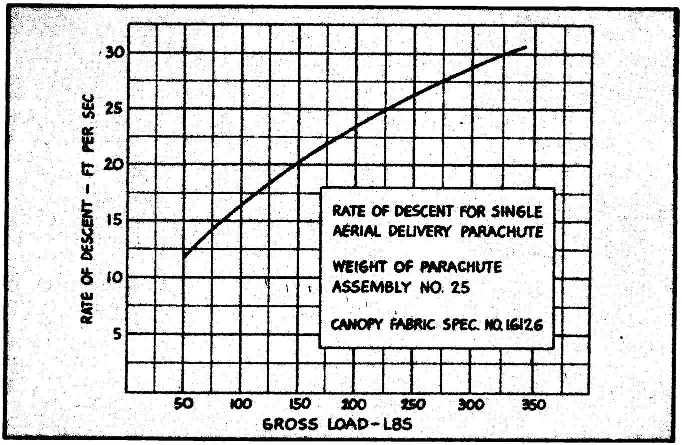


Figure 288. — Rates of descent for single aerial delivery chutes.

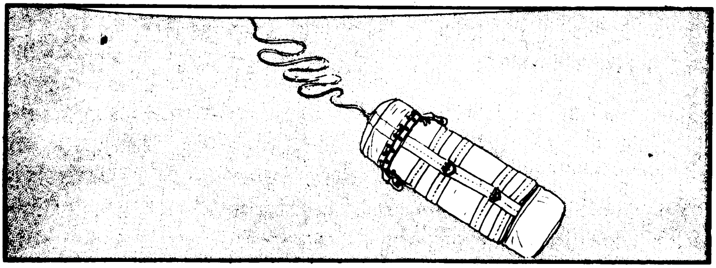


Figure 289. — Launching — load launched from opening in fuselage or from bomb racks.

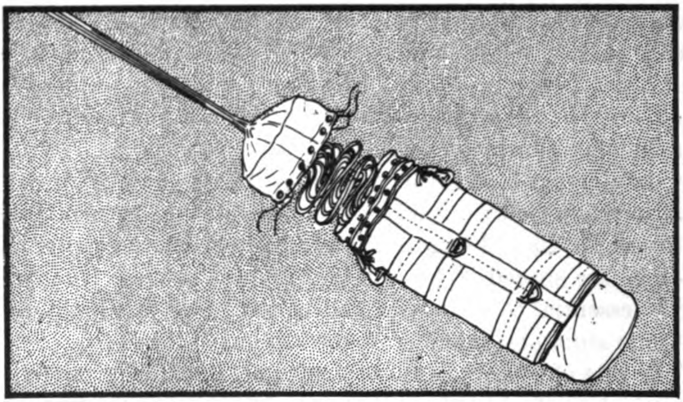


Figure 290. — Launching — static line tension breaks tie cord between pack and cover.

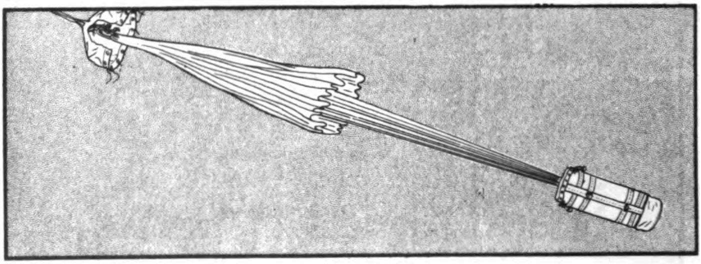


Figure 291. — Launching — breaking of break cord between static line and apex of canopy.

USE OF COLORED CANOPIES AND LIGHTS FOR IDENTIFICATION OF AERIAL DELIVERY LOADS

A scheme for distinctive marking of delivery units is advisable to enable personnel to quickly determine the contents and destination of loads. This is most important with unit type delivery models. Different loads may be marked for identification in a number of ways, the most satisfactory of which is by the use of COLORED CANOPIES.

To further facilitate identification of loads, a system of LARGE

NUMBERS — either stenciled or sewn on canopies — may be employed.

COLORED LIGHTS

Type A-1 Identification Lamp Assembly, Specification No. 94-32355, consists of a plastic cylinder about the size of an ordinary flashlight, with a flashlight-lamp-socket at each end, over which may be placed clear or colored translucent plastic caps of red, yellow, blue, or green. One of the lamp-socket fixtures unfastens to permit loading the cylinder with three standard flashlight batteries, size C.

Attached to the outside of the cylinder are two metal loops for attaching the lamp to the load. At one end of the cylinder is a spring contact metal switch, equipped with an insulating fiber separator to hold the switch open, except when the light is in actual use.

This lamp has been developed to provide a means of marking the fall of aerial delivery loads at night and to provide identification of loads by the use of various colored lights.

ASSEMBLY AND USE

The lamp cylinder is loaded with batteries, and any combination of colored or clear and colored caps may be used.

The lamp is fastened to the side of the load by tape passed through the metal loops on the lamp and tied to the lower set of grommets on the parachute pack.

In order for the light to function, the insulating fiber separator must be removed from the switch. Pass a five-strand cord through the perforated hole in the separator and tie the other end to a grommet of the pack cover in such manner that when the load is dropped and the pack cover pulled from the pack, the separator will be disengaged from the switch and the light will automatically operate.

IMPROVISED CARGO CHUTES

You may have occasion to improvise cargo chutes. This will involve the fashioning of a canopy and the devising of a pack and container.

A canopy may be made from a square piece of airplane cloth or material salvaged from surveyed parachutes. Anchor the shroud lines at the four corners of the square canopy, and gather the free ends of the shroud lines into a thimble. A simple pack can then be attached to the thimble. There are various types of attachments. Thimbles of different sizes or hooks made from a part of the parachute suspension system may be used for this purpose. The load may be secured with ropes, straps, or other convenient means.

With several adaptations, surveyed QAC or SS type parachutes can be used for aerial delivery. All such chutes must be stamped "CARGO" in large letters to assure that the units are never returned to man-carrying service.

QUIZ

1. What use is made of aerial delivery parachutes?
2. What publication contains tests and restrictions on aerial delivery equipment?
3. What is the type of aerial delivery parachute used?
4. What is its maximum load capacity?
5. (a) What is the maximum air speed that it should be dropped?
   (b) What is the minimum altitude it should be dropped?
6. How is the parachute opened?
7. When packing the parachute the suspension lines are divided into (1) (2) (3) (4) groups of (6) (12) (18) (24) lines each.
8. What type of supplies is the A-5 container designed to deliver?
9. What are the four parts of the type A-6 aerial delivery container?
10. What type aerial delivery container is used for delivering small caliber arms and ammunition? What else may it be used for?
11. How are aerial delivery loads identified?
12. What markings are found on QAC and SS type parachutes which are used for aerial delivery?

CHAPTER 7

SAFETY BELTS AND SHOULDER HARNESSES

Without safety belts and shoulder harnesses, pilots would be more or less restricted to level flight — no provision would exist for holding the aviator in his seat when the plane was subjected to violent maneuvers. To overcome this obstacle, SAFETY BELTS were devised.

SHOULDER HARNESSES are an additional feature, designed for the express purpose of minimizing head injuries during crashes. When properly installed, these units prevent the pilot from lunging forward following an arrested carrier landing.

Experience in many crashes has proven conclusively that when wearing the shoulder harness, pilots can survive damage in which the cockpit structure remains reasonably intact. This includes most landing and forced-landing crashes, and the majority of other crashes where control of the aircraft is maintained.

PILOT'S SAFETY BELTS

Pilot's safety belts are furnished in three types, designated as:

Lap and shoulder-type assembly
Lap-type assembly
Shoulder straps

Figures 292, 293, and 294 illustrate these assemblies.

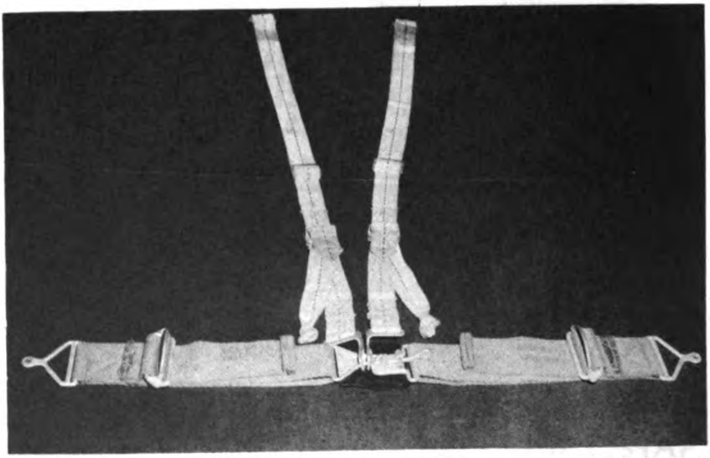


Figure 292. — Lap- and shoulder-type assembly.

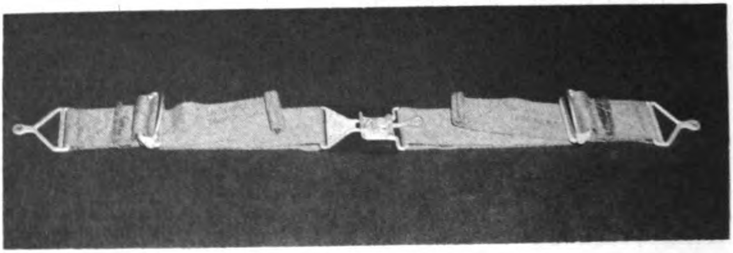


Figure 293. — Lap-type assembly.

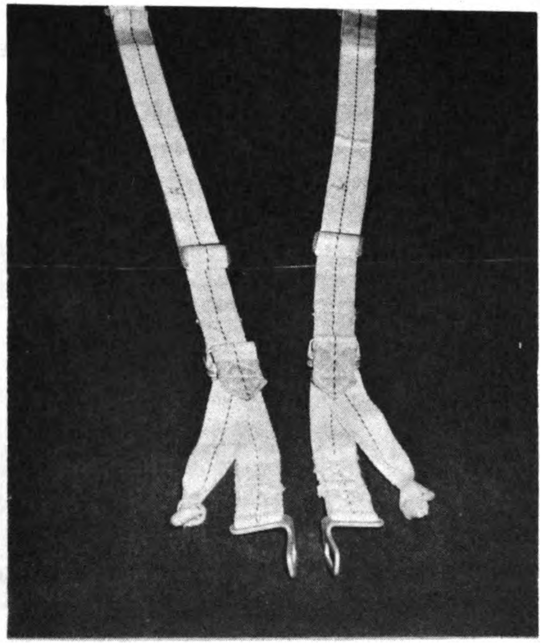


Figure 294. — Shoulder straps.

STRENGTH REQUIREMENTS

The LAP BELT, with buckle locked in place, must withstand a tensile* load of 800 pounds without failure or signs of weakening of the stitches. There must be no weakening of the release which is required to work freely after the load is removed. During application of the load, there should not be any appreciable slipping of webbing through the adjustment loops. When the load has been removed the hardware should show no evidence of deformation as the result of the stress or strain to which it was subjected.

The QUICK-RELEASE BUCKLE is subjected to a static load of 400 pounds under which a 45-pound pull on the latch should be sufficient to open the buckle.

The shoulder straps must withstand a tensile load of 700 pounds, or 350 pounds to each shoulder strap. There should be no appreciable slippage of the webbing through the adjustment loops during load application. Following removal of the load, the hardware must be in its original condition and not deformed to such extent as to preclude release from the lap-belt assembly.

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*Resistance to longitudinal stress.

GUNNER'S SAFETY BELTS

Figure 295 illustrates the gunner's-type safety belt which, when assembled and with buckle locked in place, should withstand a tensile load of 800 pounds without failure.

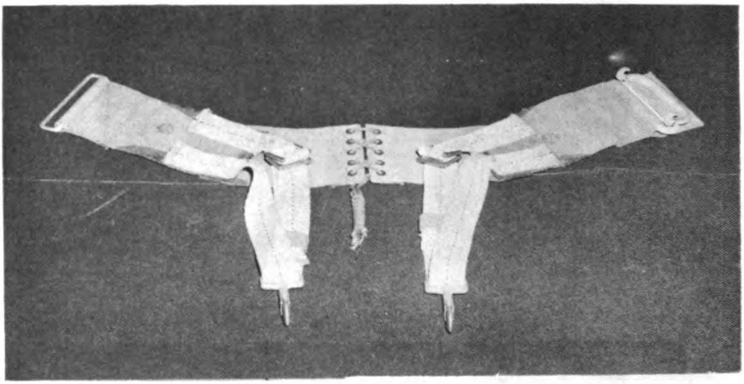


Figure 295. — Gunner's safety belt.

PERIODIC SERVICE INSPECTIONS

Safety belts and shoulder harnesses must be inspected before each flight for obvious signs of wear or deterioration of metal parts, and for fraying of webbing parts. All release buckles, snap hooks, and other operating parts should be checked for proper functioning.

After every 60 hours of flight, belts and harnesses should be thoroughly inspected for corrosion, cracks, or wear of metal parts; and for wear, deterioration, cutting, or fraying of the webbing parts; and for proper functioning of release buckles, snap hooks, and other parts including the shoulder harness spring take-up mechanisms. In addition, all parts of the aircraft with which the belts may come in contact should be inspected for sharp or ragged edges which may cause cutting or fraying of the belts. Possible sources of such damage should be eliminated by local repair or modification.

Belts and shoulder harnesses not installed in aircraft must be stored in warm, dry places, and inspected frequently for mildew or mold growth. Belts and shoulder straps suspected of exposure to dampness and those from which mold has been removed must be subjected to test prior to any further use.

Safety belts and shoulder harnesses must be subjected to proof-loads previously described at least once every six months, and at any time when routine or pre-flight inspection discloses evidence of doubtful condition of belt or shoulder harnesses. Following application of specified loads, there should be no signs of weakening or failure in metal parts, webbing, or stitchings; there should be no appreciable slippage of the webbing through adjustment-loops, and the lap-belt releases must work freely. Figure 296 shows one type of testing device simple in construction and operation.

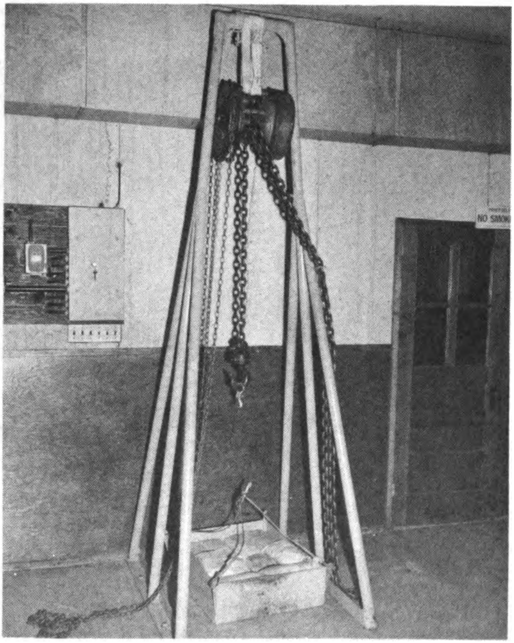


Figure 296. — Safety belt and shoulder harness testing device.

Transport passenger belts should be subjected to a tensile load of 300 pounds.

CORRECT USE OF SHOULDER HARNESS

The back of the standard aluminum pilot's seat is not designed to withstand the forward loads which the shoulder harness of the pilot's lap- and shoulder-type safety belt might impose upon it during an arrested or crash landing. For this reason, all lap and shoulder safety-belt installations have been provided with a reinforcing member over which shoulder straps are intended to pass, rather than over the less rigid seat back.

Figures 297 and 298 illustrate a typical installation in which the reinforcing member consists of a transverse tube attached to the seat-support stanchions. This type of reinforcement is most often used.

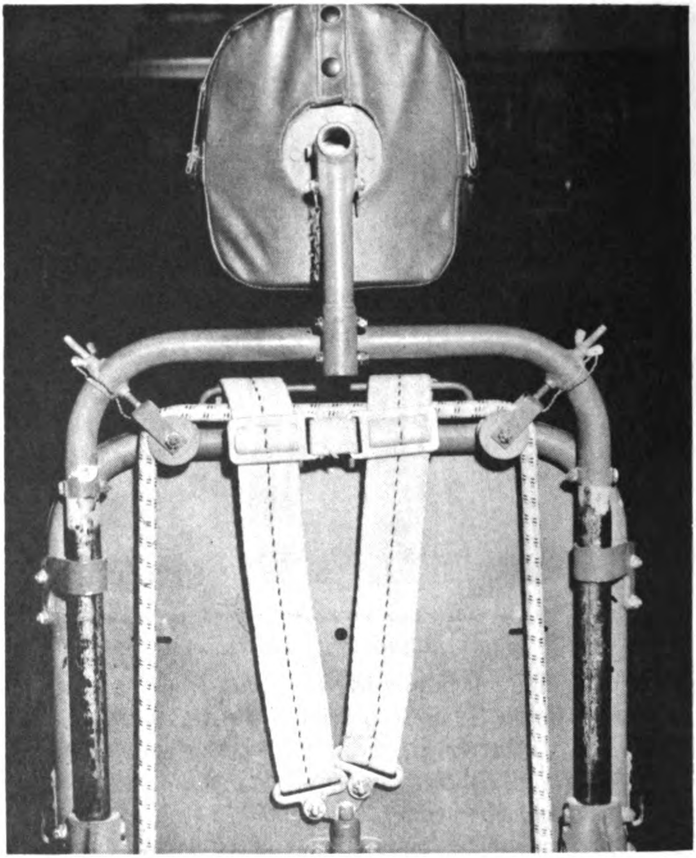


Figure 297. — Incorrect installation of shoulder harness-straps.

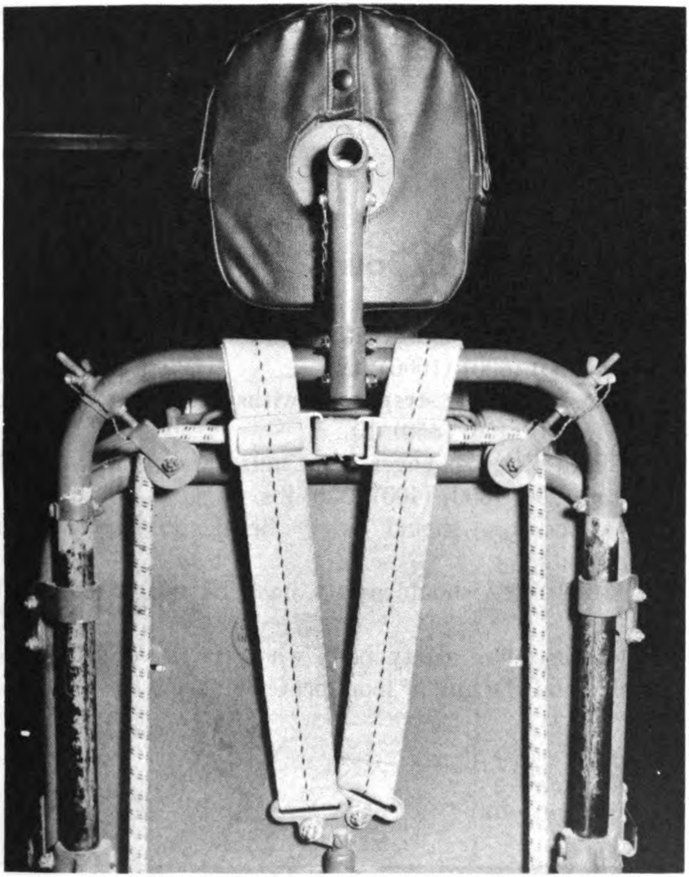


Figure 298. — Correct installation of shoulder harness-straps.

A short webbing connector-strap installed level with the pilot's shoulder blades will prevent the shoulder straps from slipping from his shoulders.

INSTALLATION

In order to standardize methods of installing safety belts in all aircraft, it has been directed that all safety belts be installed in airplanes or attached to personnel with a quick-release buckle on the left side and a link or loop on the right side, so that the pull on the hook plate or hook lever with the right hand — in a left-to-right direction — will disengage the belt assembly.

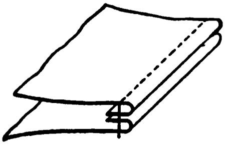
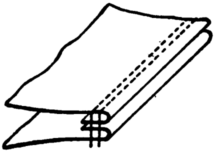
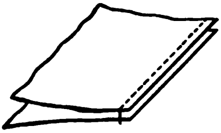
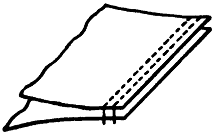
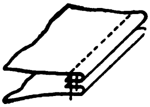
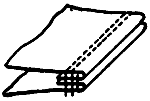
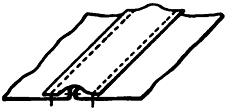
The lap-belt should be long enough to permit adjustments on pilots wearing full seat equipment, including pararaft.

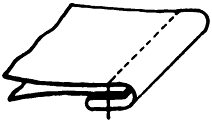
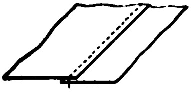
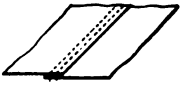
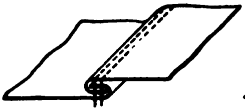
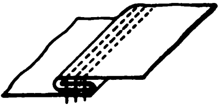
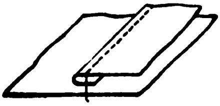
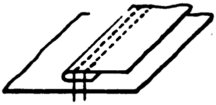
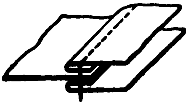
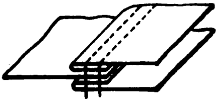
QUIZ

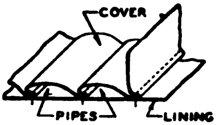
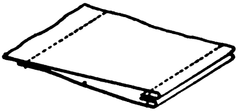
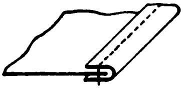
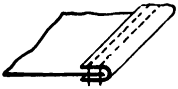
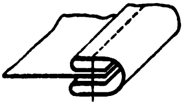
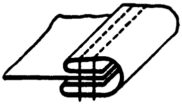
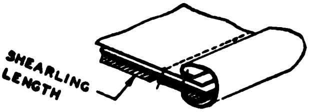
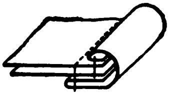
1. What are the three types of safety belts?
2. (a) The lap belt must withstand a tensile load of (200) (400) (600) (800) (1000) lbs.
   (b) Each shoulder strap must withstand a tensile load of (250) (350) (450) (550) lbs.
   (c) Transport passenger belts must withstand a tensile load of (200) (300) (400) (500) lbs.
3. (a) How often should safety belts and harnesses be inspected?
   (b) How often should safety belts be tested for tensile strength?
4. When installing safety belts where is the quick release buckle and the link or loop located?

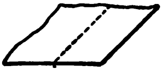
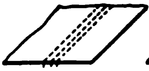
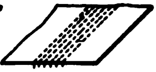
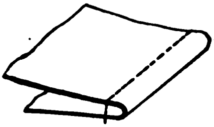
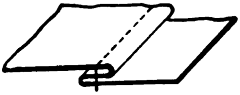
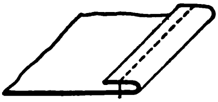
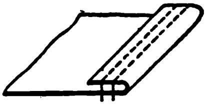
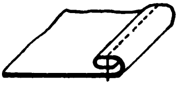
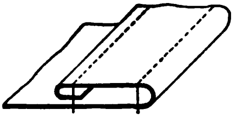
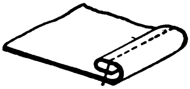
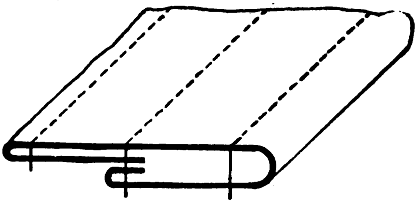
APPENDIX I

SEAMS

Machine Sewing	Use
 SSa–1  SSa–2	First step in the formation of other types of seams. Used alone on selvage edges, raw edges of leather; raw edges of cloth and webbing that have been waxed.
 SSc–1  SSc–2	Used alone where it is unnecessary to use seam that is normally formed before turning edges under.
 SSe–2  SSe–3	Cuffs, collars, edge stitching on flying clothing.
 SSf–2	For reinforcing tape on raw edges of clothing and of covers that are manufactured from leather, fabric, duck, or rubberized material. (Substitute for furrier's seam.)

Machine Sewing	Use
 SSl–1	Clothing and covers where it is necessary to have outside edge smooth; eliminates use of binding tapes.
 LSa–1  LSa–2	Seaming strips of duck fabric or pieces of leather. Strips of artificial leather, duck, or fabric joined only along selvage edges.
 LSc–2  LSc–3	Same as that of LSa–1 and 2, but smoother and stronger, especially in tension.
 LSd–1  LSd–2	For neatly finished edges, attaching pocket on clothing, attaching interior and exterior pockets on bags for flying clothing.
 LSe–1  LSe–2	Attaching wristlets or skirts to flying jackets.

MACHINE SEWING	USE
 LSae—1	For small pockets that are required to hold tools or similar articles under sewing cushions that are stuffed with paper.
 LSag—2	Reinforcement on clothing and covers.
 BSa—1  BSa—2	Flying clothing, parachute packs. small pen.
 BSc—1  BSc—2	Binding for covers, panels, bags, helmets. Especially good on materials that fray at edge—such as cloth or artificial leather.
 BSf—2	Seams and binding edges on helmets, gauntlets, and shoes.
 BSg—2	Seaming and binding edge on cloth helmets.

MACHINE SEWING	USE
 OSa–1  OSa–3  OSa–6	Ornamental on belts, straps and collars.
 OSf–1	Finishing the edge on helmets. The inserted cord acts as a drawstring.
 OSe–1	Tucking, pleating.
 EFa–1  EFa–2	Hemming the edges of panels, tapes, and webbing.
 EFb–1  EFb–2	Large covers and panels after selvage edge has been cut, where edge requires a reinforcement in order to set grommets, eyelets or hooks.
 EFb–1	EFb–1 alone—drawstring hem on bags.
 EFj–3	Straps for clothing made from cope horsehide, leather, or cloth.

APPENDIX II

TENSILE STRENGTHS

COTTON WEBBING

Type	Minimum Breaking Strength (*pounds*)
I	350
II	575
III	750
IV	1900
V	3100
VI	1800
VII	2600
VIII	2900
IX	4500
X	5000
XI	1000
XII	1000
XIII	3400

Uses: Parachute harnesses and packs. Bomb hoists and slings.

Notes: Cotton webbing is the type used most extensively in parachutes. The filling yarns of types VIII and X cotton webbing are nylon. Filling for remaining types is cotton.

LINEN WEBBING

Type	Minimum Breaking Strength (*pounds*)
I	350
II	475
III	600
IV	600
V	600
VI	1200
VII	2800
VIII	3000
IX	4000
X	5000

Uses: Same as for cotton webbing.

WEBBING, ELASTIC COTTON

CLASS	WIDTH	THICKNESS	LOAD TO PRODUCE 50% ELONGATION
I (light)	**1 inch**	**1/32 — 1/64**	**3.00 — 4.50**
II (medium)	**1-1/2 inch**	**1/8 — 1/32**	**7.20 — 17.50**
III (heavy)	**1-1/2 inch**	**1/8 — 1/32**	**15.30 — 31.25**

USES:

Class I	Headbands for aviators' face masks and goggles, parachute packs, and for harness elastic on gas-mask face pieces.
Class II	Suspenders of winter flying suits.
Class III	Rip-cord grip pocket for parachutes.

NOTES: Unless otherwise specified, Class I webbing shall be furnished in the natural unbleached state. Class II webbing shall be furnished with the face black and the back white, and Class III webbing shall be furnished in air gray.

WEBBING, TUBULAR NYLON

TYPE	TYPE I	TYPE II
Size (width)	**1 inch — 1/2 inch**	**1 inch — 1/2 inch**
Tensile Strength	**3000 1000**	**3000 1000**

USES: Suspension webs on certain type aerial delivery parachutes. Vent reinforcement.

NOTES: Type I — bright first quality.
Type II — regenerated.
Type I is for use on man-carrying parachutes.

HARNESS HARDWARE

HARDWARE	TENSILE STRENGTH
Link	3000 pounds
Quick-connector link	5000 pounds
Adapter (Shoulder Adapter or Adjuster)	1000 pounds
Double Adapter (Adjuster)	1000 pounds
Triple Adapter	1000 pounds
Snap Hook (Harness Snap)	2500 pounds
Quick-connector snap ("D" shaped)	5000 pounds
"V" ring	2500 pounds
Adjustable "V" ring	2500 pounds
Lobe hook-snap (QAS chest snap)	2500 pounds
Friction Hardware	2500 pounds

USES: Used on parachute harnesses, lift-web assemblies, slings, etc.

NOTES: The adjustable "V" ring comes in handy for use on attachable slings.

All quick-attachable hardware is 5000 pounds strong, or better. There are a number of old links still in service which are but 2500 pounds strong.

It must be understood that the tensile strengths given are quoting minimum breaking strength requirements. Hardware as well as fabrics must be at least as strong as the quoted breaking strength. Hardware and fabrics will usually test higher than the minimum figure given, providing it is in good condition.

THREADS AND CORDS

TYPE	TENSILE STRENGTH
24 x 4 thread (cotton)	4.4 pounds
16 x 4 thread (cotton)	6.35 pounds
30 x 3 thread (linen)	10.00 pounds
"B" silk thread	3.8 pounds
"E" silk thread	8.50 pounds
"B" nylon thread	3.8 pounds
"E" nylon thread	8.50 pounds
6-cord (cotton)	37.00 pounds
6-cord (linen)	38.00 pounds
9-cord (cotton)	51.00 pounds
9-cord (linen)	59.00 pounds

USES: Sewing — hand and machine.

NOTES: From time to time, the tensile strength figures given for these threads and cords may change due to incorporation of improvements in materials, manufacturing methods, or demand. In fact, an entirely different thread or cord may be substituted for a certain thread which is now doing the job perfectly. To keep abreast of these materials, study the latest specifications.

CANOPY FABRIC

Silk	**40 pounds warp**	**40 pounds fill**
Nylon	**50 pounds warp**	**50 pounds fill**
Tear resistance	**4 pounds warp**	**4 pounds fill**

USES: Man-carrying parachute canopies.

NOTES: Study Federal Specifications concerning fabric strength testing.

SUSPENSION LINE

Silk Type III	**450 pounds**
Nylon Type III	**550 pounds**
Silk Type I	**100 pounds**
Nylon Type I	**100 pounds**

USES: Type III shroud line used on main canopy of man-carrying chutes.
Type I shroud line used on pilot chutes.

REINFORCING TAPE

Silk Surgeon's Tape (pure)	**800 pounds**
Silk Surgeon's Tape (cotton filler)	**280 pounds**
Nylon Reinforcing Tape (cotton filler)	**280 pounds**

USES: Used in skirt hem.

PACK-OPENING ELASTICS

OVERALL DIAMETER	LOAD FOR 100% ELONGATION	BREAKING STRENGTH
3/16	**6 — 12 pounds**	**35 pounds**

USES: Parachute pack-opening elastics.

NOTES: A specimen of finished cord is tested to 200% elongation (three to nine inches) as specified without failure of the braid.

FABRIC, PROCESSED PARACHUTE PACK

The average breaking strength of the finished fabric, tested grab method, shall not be less than 190 pounds per inch in the warp and 115 pounds per inch in the fitting.

COTTON DUCK AIRGRAY

(Type II 12 ounce hard texture)

Warp 185 pounds **Filler 110 pounds**

TAPE COTTON

WIDTH	TENSILE STRENGTH	TYPE II
1/2 inch	**110 pounds**	**Tape — herringbone weave**
3/4 inch	**165 pounds**	**Type III**
1 inch	**220 pounds**	
1 = 1-4 inch	**275 pounds**	**Tape — twill weave**
1-1/2 inch	**330 pounds**	
1-3/4 inch	**375 pounds**	
2 inches	**425 pounds**	

USES: Used for binding, reinforcements, suspension line loops, etc.

VENT RING

Molded Elastic
4 inches in diameter

Breaking strength of not less than seven pounds. The elongation shall be at least 710 per cent.

APPENDIX III

ANSWERS TO QUIZZES

CHAPTER 1

FASTENERS

1. Regular type and separating type.
2. To prevent the slider from running off the track.
3. A screwdriver should be inserted between the jaws gently prying them apart until free operation is obtained.
4. Carbon tetrachloride.
5. By applying one drop of oil between thumb and forefinger and then running the chain up and down between the fingers.
6. Twist in opposite directions.
7. 1/2 inch.
8. Stretch the zipper and not the material.
9. Set is convenient for closing the teeth by hand.
10. The dura-dot type.
11. (a) A reinforcement around a hole.
    (b) It may be round, square, or oblong.
    (c) The grommet and washer.
12. A reinforcing patch should be made.

CHAPTER 2

SEWING MACHINES

1. The diameter of the shank and the distance from the shank to the eye.
2. (a) The larger the number the larger the eye.
   (b) The larger the number the smaller the eye.
3. Left twist for the needle and either left or right twist for the bobbin.
4. (a) Yes. When in continuous use, twice a day.
   (b) It should be kept saturated.
5. 3,000.
6. (a) Adjustments are made with the thumb nuts located on the tension studs.
   (b) To increase tension, turn in clockwise direction. To decrease tension, turn in counter-clockwise direction.

7. By the screw nearest the center of the tension spring located on the outside of the bobbin case.
8. To hold back the slack of the needle threads until the eye of each needle almost reaches the material in its descent.
9. 3500 RPM.
10. To take up any wear or loose motion between the feed eccentric and the eccentric body.
11. 2200 stitches per minute.
12. Highest point.
13. (a) Double zigzag machine.
    (b) For anchoring shroud lines in the parachute canopy and for sewing shroud line ends at the harness links.
14. By means of the needle vibrator regulating spindle feed.
15. Lower.
16. (a) Attaching containers to parachute harnesses and for sewing tarpaulins.
    (b) 1500 stitches per minute.
17. To prevent the hook from getting out of time.
18. (a) For stitching parachute harness and heavy leather work.
    (b) 400 stitches per minute.
19. (a) Fully cover the eyelets in the thread posts.
    (b) To keep the wax from burning.
    (c) 3/4 full.
20. No. The hot wax has a weakening effect on the parachute harness.

CHAPTER 3

PACKING AND RIGGING

1. (a) For smoothing out canopy folds.
   (b) As a packing stick to facilitate tucking in of corner flaps. It also may be used for smoothing down the main flaps of the container when the pack is closed.
   (c) Used to draw shroud lines into hesitator loops in the container.
   (d) Used to pull the side flaps of the container together and to draw the locking cones up through the metal grommets and end-tabs.

1. (e) Used to weight down the canopy or parts of the harness and to keep the canopy gores folded and smoothed during the packing operation.
   (f) Used to hold the container closed over the folded canopy so that the up-cord pins may be inserted.
2. (a) When the container and harness has made a complete turn either up or down between both groups of shroud lines.
   (b) When the container and harness pass in and around the other lines.
3. 6-cord doubled and waxed.
4. Turn the chute in to a major overhaul station.
5. 3/4.
6. Just aft the hem because bringing the fold even with the hem would create too much bulk in packing the chute.
7. 22 pounds.
8. 14, 4, 7.
9. 18-inch.
10. (a) They are passed through the keepers under the main sling and tacked in place.
    (b) To the pack-end flap.
11. By two lengths of webbing, one sewn to each side of the parachute harness main sling.
12. By the use of a quick-release snap.
13. (a) Exclusively for premeditated jumps.
    (b) 2.
14. One on each leg strap and one on each side of the body at the lower part of the chest strap.
15. No. Such practice tends to break tackings and to disarrange lines.

CHAPTER 4

DROP TESTING

1. (a) Releasing from the aircraft a dummy equipped with a parachute.
   (b) Permits checking the design features and operation, and the strength of material in the parachute.
2. (a) 25 and 50 pounds.
   (b) By screw plugs.

3. 400 pounds.
4. At speeds up to 325 miles per hour.
5. (a) In the bomb bays or tunnel hatches.
   (b) Weather with a wind velocity of not more than 12 miles per hour, a temperature of 59° F., and a humidity of 57 per cent.
   (c) Bureau of Aeronautics.
6. Bureau of Aeronautics.

CHAPTER 5

JUMPING

1. The Commanding Officer of the station on which the jump is to take place.
2. (a) Pull the lift webs on the left side.
   (b) Into.
   (c) Nearest.
3. Get out of the harness.
4. By pulling in on the upper shroud lines.
5. Bail-out oxygen bottle and an oxygen mask.

CHAPTER 6

AERIAL DELIVERY

1. They are used for dropping loads of supplies and equipment from aircraft.
2. The ASO catalog.
3. G-1.
4. 300 pounds.
5. (a) 150 m.p.h.
   (b) 300 feet.
6. By means of a static line attached to the airplane and parachute. The strain of the static line is transmitted to the webbing strips which in turn snap the pack lacings.
7. Two groups of 12 lines each.
8. Rifles, ammunition, and similar equipment.

9. (a) A corrugated fiber carton.
    (b) A canvas cover.
    (c) A webbing sling or harness.
    (d) A shock absorbing pad.
10. The type A-7. It may also be used for delivering five-gallon cans of water and other liquids.
11. By using colored canopies and various colored lights.
12. They are stamped "CARGO" in large letters.

CHAPTER 7

SAFETY BELTS AND SHOULDER HARNESSES

1. (a) Lap and shoulder type.
    (b) Lap-type.
    (c) Shoulder straps.
2. (a) 800 pounds.
    (b) 350 pounds.
    (c) 300 pounds.
3. (a) Before each flight.
    (b) At least once every 6 months and whenever pre-flight inspection reveals a doubtful condition.
4. The quick-release buckle is located on the left side and the link or loop on the right side.

APPENDIX IV

QUALIFICATIONS FOR ADVANCEMENT IN RATING

PARACHUTE RIGGERS (PR)

RATING CODE NO. 820

General Service Rating

Parachute riggers service, maintain, and repair aviation survival equipment and flight clothing. They are skilled in the operation of sewing machines and in the procedures for maintaining, as well as instructing in the use of, parachutes, life rafts, life jackets, survival provisions, and special equipment packets, oxygen breathing apparatus, and air-sea rescue equipment carried by aircraft.

Emergency Service Rating

Same as General Service Rating.

Naval Job Classifications

Group Code Numbers	*Group Titles*
53500–53599	Airplane accessory repairmen, miscellaneous
59200–59299	Parachute Riggers and Repairmen

Qualifications for Advancement in Rating

	Qualifications for advancement in rating	Applicable rates PR 820
xxx.100	PRACTICAL FACTORS	
.101	TOOLS	
	Use tools applicable to servicing parachutes and survival equipment	3, 2, 1, C
.102	INSTRUMENTS	
	Use measuring instruments applicable to servicing parachutes and survival equipment. Use instruments to obtain temperature and relative humidity	3, 2, 1, C
	Use instruments for drop testing, such as barometric pressure releases, timing releases, tensiometers, "G" instruments, etc	1, C

Qualifications for advancement in rating	Applicable rates PR 820
.103 BLUEPRINTS	
Read and use blueprints in repairing and modifying parachutes and survival equipment	3, 2, 1, C
.104 PREMEDITATED JUMP	
Make at least one premeditated, free-fall parachute descent with a parachute personally packed under the direct supervision of a qualified parachute rigger. (At the discretion of the officer-in-charge, this requirement may be waived when such action is deemed necessary for the good of the service)	3, 2, 1, C
.105 PARACHUTES	
Pack all types of lifesaving and cargo parachutes. Pack without assistance or supervision and be willing to perform a jump with a personally packed, and passed as perfect, parachute. Handle, stow, and issue parachutes for flight personnel; maintain records. Set and install all types of fasteners used in survival equipment. Perform minor repairs to parachute canopies and sub-assemblies	3, 2, 1, C
Recognize stains commonly found in parachutes in service, determine the correct, non-injurious cleaning agent, and employ the best method to clean the fabric. Manufacture minor sub-assemblies of parachutes and perform required alterations or major repairs. Rig and load drop-testing dummies in accordance with current AN specifications. Construct various types of lift web and sling assemblies for use with cargo parachutes and cargo to be dropped	2, 1, C
Conduct a drop test in accordance with current AN specifications	1, C
Perform major repair operations and rebuild lifesaving equipment	1, C
.106 SEWING MACHINES	
Use and "time" all types of standard sewing machines. Perform routine servicing and upkeep of sewing machines	3, 2, 1, C
Maintain and repair sewing machines	1, C
.107 OXYGEN AND CO_2 EQUIPMENT	
Perform upkeep on oxygen masks; test oxygen and CO_2 cylinders for proper charge; clean, stow, and issue for service oxygen masks	3, 2, 1, C
Install and text oxygen cylinders and connections for proper operation	2, 1, C
Transfer, test, and service all oxygen and CO_2 equipment installed in aircraft in accordance with current specifications	1, C
.108 SAFETY BELTS AND WEBBING	
Inspect, test, and install safety belts and shoulder harnesses according to AN specifications	3, 2, 1, C

	Qualifications for advancement in rating	Applicable rates PR 820
	Manufacture, according to drawings, patterns, and templates, various types of fabric work and webbing assemblies, including safety belts, shoulder harnesses, slings, and hoists used in naval aviation survival equipment	1, C
.109	Survival Equipment (General)	
	Equip and pack all types of life rafts and standard aviation survival equipment; make patches and minor repairs to rubberized fabrics, including rubber life jackets and life rafts; inspect, equip, stow, issue, and make repairs to flight clothing and personal protective or survival equipment	3, 2, 1, C
.110	Supplies	
	Employ proper supply procedures for procurement, custody, issue, storage, and accounting of equipment	3, 2, 1, C
.111	Records and Reports	
	Prepare records and reports	3, 2, 1, C
.112	Publications	
	Use applicable publications, technical letters, etc., for maintenance and employment of aviation safety and survival equipment	3, 2, 1, C
.113	Supervision	
	Supervise and train personnel; demonstrate procedures and various techniques to be employed in the use and maintenance of parachutes and all survival equipment	1, C
	Organize and administer loft or repair facilities for aviation survival equipment	C
xxx.200	EXAMINATION SUBJECTS	
.201	Tools, Weights and Measures	
	Kinds and uses of tools used in aviation safety equipment repairs; weights and measures involved in testing strengths of materials; manner of obtaining temperature and relative humidity and their significance for stowage of perishable safety equipment; the approximate weights of principal survival equipment	3, 2, 1, C
	Methods used to operate and record readings of all types of instruments used in drop testing and parachute laboratories	1, C
.202	Parachutes	
	Component parts, materials, manner of construction, care of handling fabrics, operation of service and cargo types, manner of packing and stowing	3, 2, 1, C
	Methods used to detect stains, clean and make major repairs to parachutes and subassemblies. Procedures used to set up a parachute loft and to conduct drop tests	1, C

Qualifications for advancement in rating	Applicable rates PR 820
.203 SURVIVAL EQUIPMENT	
Nomenclature and procedures for testing and installing safety belts and shoulder harnesses. Types and uses of life rafts and survival equipment packets; techniques of packing survival equipment and life rafts. Types and methods of testing rubber life jackets	3, 2, 1, C
Types of oxygen installations and equipment; manner of servicing, testing, and maintaining oxygen equipment. Safety precautions involved in handling oxygen	2, 1, C
.204 SEWING	
Momenclature, terms used, and methods of servicing sewing machines. Types of seams and stitching	3, 2, 1, C
Maintenance procedures and manner of repairing sewing machines	1, C
.205 MATERIALS	
Types, styles, and sizes of slide fasteners, threads, and needles; cleaning materials and their uses and precautions; properties of cotton, silk, rayon, leather, nylon, and webbing: their weaves, tensile strengths, durability, and general characteristics. Properties of pure and synthetic rubber and rubber cement	3, 2, 1, C
.206 SURVIVAL TECHNIQUES	
Procedures for jumping and for handling all survival equipment	1, C
.207 SAFETY PRECAUTIONS	
Safety precautions to be observed in operating sewing machines and other equipment pertaining to the repair of survival equipment	3, 2, 1, C
.208 SUPPLIES	
Basic supply procedures to be followed for procurement, custody, issue, storage, and accounting of survival equipment	3, 2, 1, C
.209 RECORDS AND REPORTS	
Records kept and reports submitted	3, 2, 1, C
.210 PUBLICATIONS	
General content and use of technical bulletins, publications, and catalogs pertaining to aviation survival	3, 2, 1, C
.211 ORGANIZATION	
Organization of Air Department at own station	3, 2, 1, C
Organization of naval aviation	1, C

xxx.300 NORMAL PATH OF ADVANCEMENT TO WARRANT GRADE

Parachute riggers advance to Warrant CARPENTER 7712 (*Aviation Survival Technician*), and act as assistants to Engineer Officers as Material Officers in charge of aviation safety and survival equipment and flight clothing.

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